1.1.2 & 1.2.2

Supporting Documents- IKG PTU Campus, Hoshiarpur

Copy of Syllabus of All Programs Offered (Indicating CBCS / Electives) Approved by the Board

PUNJAB TECHNICAL UNIVERSITY

Scheme & Syllabus of
B. Tech. Computer Science & Engineering
[CSE]

5th-8th Semester for affecting Batch 2011 and

3rd-8th Semester for affecting Batch 2012 and

By

Board of Studies Computer Science Engineering/ Information Technology / Computer Applications

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Punjab Technical University

B.Tech. Computer Science Engineering (CSE)

Third Semester **Contact Hours: 30 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCS301	Computer Architecture	3	1	-	40	60	100	4
BTAM302	Mathematics –III	3	1	-	40	60	100	4
BTCS303	Digital Circuits & Logic Design	3	1	-	40	60	100	4
BTCS304	Data Structures	3	1	-	40	60	100	4
BTCS305	Object Oriented Programming using C++	3	1	-	40	60	100	4
BTCS306	Data Structures Lab	-	-	4	30	20	50	2
BTCS307	Institutional Practical Training[#]	-	-	-	60	40	100	1
BTCS308	Digital Circuits & Logic Design Lab	-	-	2	30	20	50	1
BTCS309	Object Oriented Programming using C++ Lab	-	-	4	30	20	50	2
	Total	**15**	**5**	**10**	**350**	**400**	**750**	**26**

[#] The marks will be awarded on the basis of 04 weeks Institutional Practical training conducted after 2nd semester

Fourth Semester **Contact Hours: 30 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCS401	Operating Systems	3	1	-	40	60	100	4
BTCS402	Discrete Structures	3	1	-	40	60	100	4
BTCS403	Computer Networks-I	3	1	-	40	60	100	4
BTCS404	Microprocessor& Assembly Language Programming	3	1	-	40	60	100	4
BTCS405	System Programming	3	1	-	40	60	100	4
BTCS406	Operating System Lab	-	-	2	30	20	50	1
BTCS407	Computer Networks-I Lab	-	-	4	30	20	50	2
BTCS408	Microprocessor& Assembly Language Programming Lab	-	-	2	30	20	50	1
BTCS409	System Programming Lab	-	-	2	30	20	50	1
General Fitness					100	-	100	-
	Total	**15**	**5**	**10**	**420**	**380**	**800**	**25**

Fifth Semester **Contact Hours: 29 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCS501	Computer Networks –II	3	1	-	40	60	100	4
BTCS502	Relational Database Management System	3	1	-	40	60	100	4
BTCS503	Design & Analysis of Algorithms	3	1	-	40	60	100	4
BTCS504	Computer Graphics	3	1	-	40	60	100	4
BTCS505	Computer Peripherals & Interfaces	3	0	-	40	60	100	3
BTCS506	RDBMS Lab	-	-	4	30	20	50	2
BTCS507	Computer Networks –II Lab	-	-	2	30	20	50	1
BTCS508	Design & Analysis of Algorithms Lab	-	-	2	30	20	50	1
BTCS509	Computer Graphics Lab	-	-	2	30	20	50	1
BTCS510	Industrial Training*	-	-	-	60	40	100	1
	Total	**15**	**4**	**10**	**380**	**420**	**800**	**25**

***The marks will be awarded on the basis of 06 weeks industrial training conducted after 4th semester**

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Sixth Semester **Contact Hours: 30 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCS601	Simulation and Modeling	3	-	-	40	60	100	3
BTCS602	RDBMS -II	3	1	-	40	60	100	4
BTCS603	Software Engineering	3	-	-	40	60	100	3
BTCSXXX	Elective –I	3	1	-	40	60	100	4
BT***	Open Elective	3	1	-	40	60	100	4
BTCS604	RDBMS-II Lab	-	-	4	30	20	50	2
BTCS605	Free/ Open Source Software Lab	-	-	4	30	20	50	2
BTCS606	Software Engineering Lab	-	-	2	30	20	50	1
BTCS607	Simulation and Modeling Lab	-	-	2	30	20	50	1
General Fitness					100	-	100	
Total		**15**	**3**	**12**	**420**	**380**	**800**	**24**

Seventh Semester / Eighth Semester **Contact Hours: 29 Hrs**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCS701	Artificial Intelligence	3	-	-	40	60	100	3
BTCS702	Theory of Computation	3	1	-	40	60	100	4
BTCS 703	Project	-	-	12	150	150	300	12
BTCSYYY	Elective –II	3	1	-	40	60	100	4
BTCSZZZ	Elective –III	3	1	-	40	60	100	4
BTCS704	Artificial Intelligence Lab	-	-	2	30	20	50	1
General Fitness					100	-	100	
Total		**12**	**03**	**14**	**440**	**410**	**850**	**28**

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Course Code	Course Name	Marks Distribution		Total Marks	Credits
		Internal	External		
BTCS801	Software Training	150	100	250	8
BTCS802	Industry Oriented Project Training	300	200	500	10
Total		**450**	**300**	**750**	**18**

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Elective –I BTXS XXX

- BTCS 901 Web Technologies
- BTCS 902 Mobile Applications Development
- BTCS 903 Ethical Hacking
- BTCS 904 Information Security

Elective –II BTCS YYY

- BTCS 905 Software Testing and Quality Assurance
- BTCS 906 Object Oriented Analysis and Design
- BTCS 907 Software Project Management
- BTCS 908 Business Intelligence
- BTCS 909 Agile Software Development

Elective -III BTCS ZZZ

- BTCS 910 Multimedia and Application
- BTCS 911 Soft Computing
- BTCS 912 Cloud Computing
- BTCS 913 Compiler Design
- BTCS 914 Big Data
- BTCS 915 Digital Image Processing
- BTCS 916 Enterprise Resource Planning

Third Semester

BTCS 301 Computer Architecture

Objectives: This course offers a good understanding of the various functional units of a computer system and prepares the student to be in a position to design a basic computer system.

1. **Register Transfer and Microoperations:** Register transfer language & operations, arithmetic microoperations, logic microoperations, shift microoperations, arithmetic logic shift unit. Design of a complete basic computer and its working. **[5]**
2. **Basic Computer Organisation and Design:** Instruction codes, Computer registers, Computer Instructions, Timing and control, Instruction Cycle, Memory reference instructions, Input/ Output and Interrupt, Design of basic Computer, Design of Accumulator Logic. **[6]**
3. **Design of Control Unit:** Control memory, design of control unit – microprogrammed, hardwired, and their comparative study. **[3]**
4. **Central Processing Unit:** General Register Organisation, Stack Organisation, Instruction formats, Addressing Modes, Data transfer and manipulations, Program control, RISC and CISC architecture. **[6]**
5. **Input-Output Organisation:** Peripheral devices, I/O Interface, asynchronous data transfer, modes of transfer, priority interrupt, DMA, I/O processor, serial communication. **[5]**
6. **Memory Organisation:** Memory hierarchy, main memory, auxiliary memory, associative memory, cache memory, virtual memory, memory management hardware. **[6]**
7. **Advanced concepts of Computer Architecture:** Concept of pipeline, Arithmetic pipeline, Instruction , vector processors and array processors. Introduction to parallel processing, Interprocessor communication & synchronization. **[5]**

Suggested Readings/ Books:

1. M. Moris Mano, **Computer System Architecture**, Pearson Education.
2. William Stallings, **Computer Organisation and Architecture**, Pearson Education.
3. David A Patterson, **Computer Architecture**, Pearson Education.
4. P. Pal Choudhri, **Computer Organisation and Design**, PHI.
5. J. P. Hayes, **Computer System Architecture**, Pearson Education.
6. Kai Hawang, **Advanced Computer Architecture**, Tata McGraw Hill.
7. Riess. **Assembly Language and Computer Architecture and using C++ and JAVA,** Cengage Learning.

BTAM302 Mathematics-III

Objective/s and Expected Outcome: To teach computer based Engineering Mathematics to students. After this course the student will be able to solve complex computer oriented problems.

1. **Fourier series**: Periodic Functions, Euler’s Formula. Even and odd Functions, Half range expansions,

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Fourier series of different waveforms. **[4]**

2. **Laplace transformations:** Laplace transforms of various standard functions, properties of Laplace transform. **[4]**
3. **Partial Differential Equations:** Formation of Partial Differential Equations, linear Partial Differential Equations, Homogeneous Partial Differential Equations with constant coefficients. **[5]**
4. **Functions of complex variables:** Limits, continuity and derivatives of the function of complex variables, Analytic function, Cauchy- Riemann equations, conjugate functions. **[5]**
5. **Linear Systems and Eigen- Values:** Gauss – elimination method, gauss- Jordan method, Gauss- Seidel iteration method, Rayleigh's Power method for Eigen values and Eigenvectors. **[4]**
6. **Differential Equations:** Solutions of Initial values problems using Eulers, modified Eulers method and Runge- kutta (upto fourth order) methods. **[4]**
7. **Probability distribution:** Binomial, Poisson and Normal distribution. **[4]**
8. **Sampling Distribution & testing of Hypothesis:** Sampling, Distribution of means and variance, Chi-Square distribution, t- distribution, F- distribution. General concepts of hypothesis, Testing a statistical Hypothesis, One and two tailed tests, critical region, Confidence interval estimation. Single and two sample tests on proportion, mean and variance. **[5]**

Suggested Readings/ Books:

1. E. Kreyszig,**" Advanced Engineering Mathematics"**, 5th Edition, Wiley Enstern 1985.
2. P. E. Danko, A. G. Popov, T. Y. A. Kaznevnikova, **"Higher Mathematics in Problems and Exercise"**, Part 2, Mir Publishers, 1983.
3. Bali, N. P., **"A Text Book on Engineering Mathematics"**, Luxmi Pub., New Delhi.
4. Peter V.O'Neil,**" Advanced Engineering Mathematics"**, Cengage Learning

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BTCS303 Digital Circuits & Logic Design

Objective/s and Expected outcome: Demonstrate the operation of simple digital gates, identify the symbols, develop the truth table for those gates; combine simple gates into more complex circuits; change binary, hexadecimal, octal numbers to their decimal equivalent an vice versa, demonstrate the operation of a flip-flop. Design counters and clear the concept of shift resisters. Study different types of memories and their applications. Convert digital into analog and vice versa.

1. **Number Systems:** Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's, rth's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII – conversion from one code to another. **[5]**
2. **Boolean Algebra:** Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean

expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, Quine-McCluskey method - Don't care conditions. **[5]**

3. **Logic GATES:** AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations. Study of logic families like RTL, DTL, DCTL, TTL, MOS, CMOS, ECL and their characteristics. **[5]**
4. **Combinational Circuits:** Design procedure – Adders, Subtractors, Serial adder/Subtractor, Parallel adder/ Subtractor Carry look ahead adder, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX.
5. **Sequential Circuits:** Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops. Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter, Ring Counters. Classification of sequential circuits-Moore and Mealy, Design of Synchronous counters: state diagram, Circuit implementation. Shift registers. **[4]**
6. **Memory Devices:** Classification of memories, RAM organization, Write operation, Read operation, Memory cycle. Static RAM Cell-Bipolar, RAM cell, MOSFET RAM cell, Dynamic RAM cell. ROM organization, PROM, EPROM, EEPROM, Field Programmable Gate Arrays (FPGA). **[4]**
7. **Signal Conversions:** Analog & Digital signals. A/D and D/A conversion techniques (Weighted type, R-2R Ladder type, Counter Type, Dual Slope type, Successive Approximation type). **[5]**

Suggested Readings/ Books:

1. Morris Mano, **Digital Design**, Prentice Hall of India Pvt. Ltd
2. Donald P.Leach and Albert Paul Malvino, **Digital Principles and Applications**, 5 ed., Tata McGraw Hill Publishing Company Limited, New Delhi, 2003.
3. R.P.Jain, Modern **Digital Electronics**, 3 ed., Tata McGraw–Hill publishing company limited, New Delhi, 2003.
4. Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, Inc, New Delhi, 2003
5. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System -Principles and Applications**, Pearson Education.
6. Ghosal , **Digital Electronics,** Cengage Learning.

BTCS 304 Data Structures

Objectives: This course should provide the students with a fairly good concept of the fundamentals of different types of data structures and also the ways to implement them. Algorithm for solving problems like sorting, searching, insertion & deletion of data etc. related to data structures should also be discussed. After completion of this subject student should be able to choose an appropriate data structure for a particular problem.

1. **Dynamic Memory Management:** Understanding pointers, usage of pointers, arithmetic on pointers, memory allocation, memory management functions and operators, debugging pointers - dangling pointers, memory leaks, etc. **[2]**

2. **Introduction:** Concept of data type, definition and brief description of various data structures, data structures versus data types, operations on data structures, algorithm complexity, Big O notation. **[2]**
3. **Arrays:** Linear and multi-dimensional arrays and their representation, operations on arrays, sparse matrices and their storage. **[3]**
4. **Linked List:** Linear linked list, operations on linear linked list, doubly linked list, operations on doubly linked list, application of linked lists. **[4]**
5. **Stacks:** Sequential and linked representations, operations on stacks, application of stacks such as parenthesis checker, evaluation of postfix expressions, conversion from infix to postfix representation, implementing recursive functions. **[4]**
6. **Queues:** Sequential representation of queue, linear queue, circular queue, operations on linear and circular queue, linked representation of a queue and operations on it, deque, priority queue, applications of queues.

7. **Trees:** Basic terminology, sequential and linked representations of trees, traversing a binary tree using recursive and non-recursive procedures, inserting a node, deleting a node, brief introduction to threaded binary trees, AVL trees and B-trees. **[4]**
8. **Heaps:** Representing a heap in memory, operations on heaps, application of heap in implementing priority queue and heap sort algorithm. **[2]**
9. **Graphs:** Basic terminology, representation of graphs (adjacency matrix, adjacency list), traversal of a graph (breadth-first search and depth-first search), and applications of graphs. **[3]**
10. **Hashing & Hash Tables:** Comparing direct address tables with hash tables, hash functions, concept of collision and its resolution using open addressing and separate chaining, double hashing, rehashing. **[3]**
11. **Searching & Sorting:** Searching an element using linear search and binary search techniques, Sorting arrays using bubble sort, selection sort, insertion sort, quick sort, merge sort, heap sort, shell sort and radix sort, complexities of searching & sorting algorithms. **[5]**

Suggested Readings/ Books:

1. Sartaj Sahni, **Data Structures, Algorithms and Applications in C++,** Tata McGraw Hill.
2. Tenenbaum, Augenstein, & Langsam, **Data Structures using C and C++**, Prentice Hall of India.
3. R. S. Salaria, **Data Structures & Algorithms Using C++,** Khanna Book Publishing Co. (P) Ltd.
4. Seymour Lipschutz, **Data Structures**, Schaum's Outline Series, Tata McGraw Hill
5. Kruse, **Data Structures & Program Design**, Prentice Hall of India.
6. Michael T. Goodrich, Roberto Tamassia, & David Mount, **Data Structures and Algorithms in C++** (Wiley India)

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7. Thomas H Cormen, Charles E Leiserson, Ronald L Rivest , and Clifford Stein, Introduction to Algorithms.
8. Ellis Horowitz, Sartaj Sahni, & Dinesh Mehta, Fundamentals of Data Structures in C++.
9. Malik , **Data Structures using C++**, Cengage Learning.

BTCS 305 Object Oriented Programming Using C++

Objectives: To understand the basic concepts of object oriented programming languages and to learn the techniques of software development in C++.

1. **Object-Oriented Programming Concepts:** Introduction, comparison between procedural programming paradigm and object-oriented programming paradigm, basic concepts of object-oriented programming — concepts of an object and a class, interface and implementation of a class, operations on objects, relationship among objects, abstraction, encapsulation, data hiding, inheritance, overloading, polymorphism, messaging. **[2]**

2. **Standard Input/Output:** Concept of streams, hierarchy of console stream classes, input/output using overloaded operators >> and << and memberv functions of i/o stream classes, formatting output, formatting using ios class functions and flags, formatting using manipulators. **[3]**

3. **Classes and Objects:** Specifying a class, creating class objects, accessing class members, access specifiers, static members, use of *const* keyword, friends of a class, empty classes, nested classes, local classes, abstract classes, container classes, bit fields and classes**.** **[4]**

4. **Pointers and Dynamic Memory Management:** Declaring and initializing pointers, accessing data through pointers, pointer arithmetic, memory allocation (static and dynamic), dynamic memory management using *new* and *delete* operators, pointer to an object, *this* pointer, pointer related problems - dangling/wild pointers, null pointer assignment, memory leak and allocation failures**.** **[5]**

5. **Constructors and Destructors:** Need for constructors and destructors, copy constructor, dynamic constructors, explicit constructors, destructors, constructors and destructors with static members, initializer lists. **[2]**

6. **Operator Overloading and Type Conversion:** Overloading operators, rules for overloading operators, overloading of various operators, type conversion - basic type to class type, class type to basic type, class type to another class type. **[4]**

7. **Inheritance:** Introduction, defining derived classes, forms of inheritance, ambiguity in multiple and multipath inheritance, virtual base class, object slicing, overriding member functions, object composition and delegation, order of execution of constructors and destructors. **[5]**

8. **Virtual functions & Polymorphism:** Concept of binding - early binding and late binding, virtual functions, pure virtual functions, abstract clasess, virtual destructors. **[3]**

9. **Exception Handling:** Review of traditional error handling, basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, rethrowing an exception, specifying exceptions. **[2]**

10. **Templates and Generic Programming:** Template concepts, Function templates, class templates, illustrative examples. **[3]**

11. **Files:** File streams, hierarchy of file stream classes, error handling during file operations, reading/writing of files, accessing records randomly, updating files. **[3]**

Suggested Readings/ Books:

1. Lafore R., **Object Oriented Programming in C++**, Waite Group.
2. E. Balagurusamy, **Object Oriented Programming with C++**, Tata McGraw Hill.
3. R. S. Salaria, **Mastering Object-Oriented Programming with C++**, Salaria Publishing House.
4. Bjarne Stroustrup, **The C++ Programming Language**, Addison Wesley.
5. Herbert Schildt, **The Complete Reference to C++ Language**, McGraw Hill-Osborne.
6. Lippman F. B, **C++ Primer,** Addison Wesley.
7. Farrell- **Object Oriented using C++,** Cengage Learning.

BTCS306 Data Structures Lab

List of practical exercises, to be implemented using object-oriented approach in C++ Language.

1. Write a menu driven program that implements following operations (using separate functions) on a linear array:
   - Insert a new element at end as well as at a given position
   - Delete an element from a given whose value is given or whose position is given
   - To find the location of a given element
   - To display the elements of the linear array
2. Write a menu driven program that maintains a linear linked list whose elements are stored in on ascending order and implements the following operations (using separate functions):
   - Insert a new element
   - Delete an existing element
   - Search an element
   - Display all the elements

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3. Write a program to demonstrate the use of stack (implemented using linear array) in converting arithmetic expression from infix notation to postfix notation.
4. Program to demonstrate the use of stack (implemented using linear linked lists) in evaluating arithmetic expression in postfix notation.
5. Program to demonstration the implementation of various operations on a linear queue represented using a linear array.
6. Program to demonstration the implementation of various operations on a circular queue represented using a linear array.
7. Program to demonstration the implementation of various operations on a queue represented using a linear linked list (linked queue).
8. Program to illustrate the implementation of different operations on a binary search tree.
9. Program to illustrate the traversal of graph using breadth-first search.
10. Program to illustrate the traversal of graph using depth-first search.
11. Program to sort an array of integers in ascending order using bubble sort.
12. Program to sort an array of integers in ascending order using selection sort.
13. Program to sort an array of integers in ascending order using insertion sort.
14. Program to sort an array of integers in ascending order using radix sort.
15. Program to sort an array of integers in ascending order using merge sort.
16. Program to sort an array of integers in ascending order using quick sort.
17. Program to sort an array of integers in ascending order using heap sort.
18. Program to sort an array of integers in ascending order using shell sort.
19. Program to demonstrate the use of linear search to search a given element in an array.
20. Program to demonstrate the use of binary search to search a given element in a sorted array in ascending order.

BTCS 307 Institutional Practical Training

BTCS 308 Digital Circuits & Logic Design Lab

Implementation all experiments with help of Bread- Board.

1. . Study of Logic Gates: Truth-table verification of OR, AND, NOT, XOR, NAND and NOR gates; Realization of OR, AND, NOT and XOR functions using universal gates.
2. Half Adder / Full Adder: Realization using basic and XOR gates.

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3. Half Subtractor / Full Subtractor: Realization using NAND gates.
4. 4-Bit Binary-to-Gray & Gray-to-Binary Code Converter: Realization using XOR gates.
5. 4-Bit and 8-Bit Comparator: Implementation using IC7485 magnitude comparator chips.
6. Multiplexer: Truth-table verification and realization of Half adder and Full adder using IC74153 chip.
7. Demultiplexer: Truth-table verification and realization of Half subtractor and Full subtractor using IC74139 chip.
8. Flip Flops: Truth-table verification of JK Master Slave FF, T-type and D-type FF using IC7476 chip.
9. Asynchronous Counter: Realization of 4-bit up counter and Mod-N counter using IC7490 & IC7493 chip.
10. Synchronous Counter: Realization of 4-bit up/down counter and Mod-N counter using IC74192 & IC74193 chip.
11. Shift Register: Study of shift right, SIPO, SISO, PIPO, PISO & Shift left operations using IC7495 chip.
12. DAC Operation: Study of 8-bit DAC (IC 08/0800 chip), obtain staircase waveform using IC7493 chip.
13. ADC Operations: Study of 8-bit ADC.

BTCS 309 Object Oriented Programming Using C++ Lab

1. **[Classes and Objects]** Write a program that uses a class where the member functions are defined inside a class.
2. **[Classes and Objects]** Write a program that uses a class where the member functions are defined outside a class.
3. **[Classes and Objects]** Write a program to demonstrate the use of static data members.
4. **[Classes and Objects]** Write a program to demonstrate the use of const data members.
5. **[Constructors and Destructors]** Write a program to demonstrate the use of zero argument and parameterized constructors.
6. **[Constructors and Destructors]** Write a program to demonstrate the use of dynamic constructor.
7. **[Constructors and Destructors]** Write a program to demonstrate the use of explicit constructor.
8. **[Initializer Lists]** Write a program to demonstrate the use of initializer list.
9. **[Operator Overloading]** Write a program to demonstrate the overloading of increment and decrement operators.
10. **[Operator Overloading]** Write a program to demonstrate the overloading of binary arithmetic operators.
11. **[Operator Overloading]** Write a program to demonstrate the overloading of memory management operators.
12. **[Typecasting]** Write a program to demonstrate the typecasting of basic type to class type.
13. **[Typecasting]** Write a program to demonstrate the typecasting of class type to basic type.
14. **[Typecasting]** Write a program to demonstrate the typecasting of class type to class type.
15. **[Inheritance]** Write a program to demonstrate the multilevel inheritance.

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16. **[Inheritance]** Write a program to demonstrate the multiple inheritance.
17. **[Inheritance]** Write a program to demonstrate the virtual derivation of a class.
18. **[Polymorphism]** Write a program to demonstrate the runtime polymorphism.
19. **[Exception Handling]** Write a program to demonstrate the exception handling.
20. **[Templates and Generic Programming]** Write a program to demonstrate the use of function template.
21. **[Templates and Generic Programming]** Write a program to demonstrate the use of class template.
22. **[File Handling]** Write a program to copy the contents of a file to another file byte by byte. The name of the source file and destination file should be taken as command-line arguments,
23. **[File Handling]** Write a program to demonstrate the reading and writing of mixed type of data.
24. **[File Handling]** Write a program to demonstrate the reading and writing of objects.

Fourth Semester

BTCS 401 Operating Systems

Objectives: This course should provide the students with good understanding of Operating System including its architecture and all its components. Good conceptions on all the subjects like processes, inter-process communication, semaphore, message passing, classical IPC problems, scheduling, memory management, file systems, security and protection mechanism, I/O hardware and software, deadlocks, etc. should be provided

1. Introduction to Operating system, Role of Operating S ystem as resource manager, function of kernel and shell, operating system structures, views of an operating system. **[5]**
2. **Process management:** CPU scheduling, Scheduling Algorithms, PCB, Process synchronization, Deadlocks, Prevention, Detection and Recovery **[5]**
3. **Memory Management:** Overlays, Memory management policies, Fragmentation and its types, Partitioned memory managements, Paging, Segmentation, Need of Virtual memories, Page replacement Algorithms, Concept of Thrashing **[8]**
4. **Device Management:** I/O system and secondary storage structure, Device management policies, Role of I/O traffic controller, scheduler **[5]**
5. **File Management:** File System Architecture, Layered Architecture, Physical and Logical File Systems, Protection and Security: **[5]**
6. Brief study to multiprocessor and distributed operating systems. **[4]**
7. **Case Studies:** LINUX / UNIX Operating System and Windows based operating systems. Recent trends in operating system.

Suggested Readings/ Books:

1. A Silberschatz and Peter B. Galvin, **"Operating System Concepts"** Addison Wesley Publishing Company
2. Dhamdhere, -**Systems Programming & Operating Systems"** Tata McGraw Hill
3. Gary Nutt, **"Operating Systems Concepts",** Pearson Education Ltd. 3rd Edition
4. **Operating System** by Madnick Donovan
5. **Operating System** by Stallings
6. Ida M.Flynn **Understanding Operating Systems** -, Cengage Learning

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BTCS402 Discrete Structures

Objective/s:

The objective of this course is to provide the necessary back ground of discrete structures with particular reference to the relationships between discrete structures and their data structure counterparts including algorithm development.

1. **Sets, relations and functions:** Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations. **[7]**

2. **Rings and Boolean algebra:** Rings, Subrings, morphism of rings ideals and quotient rings. Euclidean domains Integral domains and fields Boolean Algebra direct product morphisms Boolean sub-algebra Boolean Rings Application of Boolean algebra (Logic Implications, Logic Gates, Karnaugh- map) **[8]**

3. **Combinatorial Mathematics:** Basic counting principles Permutations and combinations Inclusion and Exclusion Principle Recurrence relations, Generating Function, Application. **[7]**

4. **Monoids and Groups:** Groups Semigroups and monoids Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups. **[7]**

5. **Graph Theory:** Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications. **[7]**

Suggested Readings/ Books:

1. Discrete Mathematics (Schaum series) by Lipschutz (McGraw Hill).
2. Applied Discrete Structures for Computer Science by Alan Doerr and Kenneth Levarseur.
3. Discrete Mathematics by N Ch SN Iyengar, VM Chandrasekaran.
4. Discrete Mathematics and Graph Theory(Cengage Learning) by Sartha
5. Discrete Mathematics and its Applications. Kenneth H Rosen.(McGraw Hill)
6. Elements of discrete mathematics. C L Liu (McGraw Hill)

BTCS403 Computer Networks–I

Objective/s and Expected Outcome: This course provides knowledge about computer network related hardware and software using a layered architecture.

1. Introduction to Computer Networks:

Data Communication System and its components, Data Flow, Computer network and its goals, Types of computer networks: LAN, MAN, WAN, Wireless and wired networks, broadcast and point to point networks, Network topologies, Network software: concept of layers, protocols, interfaces and services, ISO-OSI reference model, TCP/IP reference model. [7]

2. Physical Layer:

Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Data rate limits : Nyquist formula, Shannon Formula, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared), Switching: Circuit Switching, Message Switching ,Packet Switching & their comparisons. **[6]**

3. Data Link Layer:

Design issues, Framing, Error detection and correction codes: checksum, CRC, hamming code, Data link protocols for noisy and noiseless channels, Sliding Window Protocols: Stop & Wait ARQ, Go-back-N ARQ, Selective repeat ARQ, Data link protocols: HDLC and PPP. **[6]**

4. Medium Access Sub-Layer:

Static and dynamic channel allocation, Random Access: ALOHA, CSMA protocols, Controlled Access: Polling, Token Passing, IEEE 802.3 frame format, Ethernet cabling, Manchester encoding, collision detection in 802.3, Binary exponential back off algorithm. **[6]**

5. Network Layer:

Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector and link state routing, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms **[6]**

6. Transport Layer:

Elements of transport protocols: addressing, connection establishment and release, flow control and buffering, multiplexing and de-multiplexing, crash recovery, introduction to TCP/UDP protocols and their comparison. **[3]**

7. Application Layer:

World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), Introduction to Network security **[2]**

Suggested Readings/ Books:

1. Computer Networks, 4th Edition, Pearson Education by Andrew S. Tanenbaum
2. Data Communication & Networking, 4th Edition, Tata McGraw Hill. By Behrouz A. Forouzan.
3. Computer Networking, 3rd Edition, Pearson Education by James F. Kurose and Keith W. Ross
4. Internetworking with TCP/IP, Volume-I, Prentice Hall, India by Douglas E. Comer.
5. Guide to Networking Essentials, 5th Edition, Cengage Learning by Greg Tomsho,
6. Handbook of Networking, Cengage Learning by Michael W. Graves.

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BTCS404 Microprocessors and Assembly Language Programming

Objective/s: The course is intended to give students good understanding of internal architectural details and functioning of microprocessors.

1. **Introduction:** Introduction to Microprocessors, history, classification, recent microprocessors.**[5]**
2. **Microprocessor Architecture:** 8085 microprocessor Architecture. Bus structure, I/O, Memory & Instruction execution sequence & Data Flow, Instruction cycle. System buses, concept of address Bus, Data Bus & Control Bus, Synchronous & Asynchronous buses. **[5]**
3. **I/O memory interface:** Data transfer modes: Programmable, interrupt initiated and DMA. Serial & parallel interface, Detail study of 8251 I/O Processor & 8255 programmable peripheral interfaces.**[6]**
4. **Instruction set & Assembly Languages Programming:** Introduction, instruction & data formats, addressing modes, status flags, 8085 instructions, Data transfer operations, Arithmetic operations, Logical operations, Branch operations. **[7]**
5. **Case structure & Microprocessor application:** Interfacing of keyboards and seven segment LED display, Microprocessor controlled temperature system (MCTS), Study of traffic light system, stepper motor controller, Microprocessor based micro computers. **[8]**
6. **Basic architecture of higher order microprocessors:** Basic introduction to 8086 family, Motorola 68000, Pentium processors. **[5]**

Suggested Readings/ Books:

1. Ramesh Gaonkar, **"8085 Microprocessor "**,PHI Publications.
2. Daniel Tabak, **"Advanced Microprocessors**", McGraw- Hill, Inc., Second Edition 1995.
3. Douglas V. Hall, **" Microprocessors and Interfacing: Programming and Hardware"**, Tata McGraw Hill Edition,1986.
4. Charles M.Gilmore,**" Microprocessors: Principles and Applications"**, McGraw Hill.
5. Ayala Kenneth, **"The 8086 Microprocessor Programming and Interfacing"**, Cengage Learning

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BTCS 405 System Programming

Objective/s and Expected Outcome: This course provides knowledge to design various system programs.

1. **Introduction:** Introduction to system programming and different types of system programs – editors, assemblers, macro-processors, compilers, linkers, loader, debuggers. **[2]**
2. **Assemblers:** Description of single pass and two pass assemblers, use of data structures like

OPTAB and SYMTAB, etc. **[9]**

3. **Macroprocessors:** Description of macros, macro expansion, conditional and recursive macro expansion. **[5]**
4. **Compilers:** Various phases of compiler – lexical, syntax and semantic analysis, intermediate code generation, code optimization techniques, code generation, Case study : LEX and YACC. **[9]**
5. **Linkers and Loaders:** Concept of linking, different linking schemes, concept of loading and various loading schemes. **[5]**
6. **Editors:** Line editor, full screen editor and multi window editor, Case study MS-Word, DOS Editor and vi editor. **[4]**
7. **Debuggers:** Description of various debugging techniques. **[2]**

Suggested Readings/ Books:

1. Donovan J.J., **"Systems Programming"**, New York, Mc-Graw Hill, 1972.
2. Dhamdhere, D.M., **"Introduction to Systems Software"**, Tata Mc-Graw Hill, 1996.
3. Aho A.V. and J.D. Ullman ,**"Principles of compiler Design"** Addison Wesley/ Narosa 1985.
4. Kenneth C. Louden,**" Compiler Construction"**, Cengage Learning.

BTCS 406 Operating System Lab

1. Installation Process of various operating systems
2. Virtualization, Installation of Virtual Machine Software and installation of Operating System on Virtual Machine
3. Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in linux, connecting processes with pipes, background processing, managing multiple processes. Manual help. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file. File related commands ws, sat, cut, grep.
4. Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks, report printing.

BTCS 407 Computer Networks-I Lab

1. Write specifications of latest desktops and laptops.
2. Familiarization with Networking Components and devices: LAN Adapters, Hubs, Switches, Routers etc.
3. Familiarization with Transmission media and Tools: Co-axial cable, UTP Cable, Crimping Tool, Connectors etc.
4. Preparing straight and cross cables.
5. Study of various LAN topologies and their creation using network devices, cables and computers.
6. Configuration of TCP/IP Protocols in Windows and Linux.
7. Implementation of file and printer sharing.
8. Designing and implementing Class A, B, C Networks
9. Subnet planning and its implementation
10. Installation of ftp server and client

BTCS408 Microprocessor and Assembly Language Programming Lab

1. Introduction to 8085 kit.
2. Addition of two 8 bit numbers, sum 8 bit.
3. Subtraction of two 8 bit numbers.
4. Find 1's complement of 8 bit number.
5. Find 2's complement of 8 bit number.
6. Shift an 8 bit no. by one bit.
7. Find Largest of two 8 bit numbers.
8. Find Largest among an array of ten numbers (8 bit).
9. Sum of series of 8 bit numbers.
10. Introduction to 8086 kit.
11. Addition of two 16 bit numbers, sum 16 bit.
12. Subtraction of two 16 bit numbers.
13. Find 1's complement of 16 bit number.
14. Find 2's complement of 16 bit number.

BTCS 409 System Programming Lab

1. Create a menu driven interface for

   a) Displaying contents of a file page wise

   b) Counting vowels, characters, and lines in a file.

   c) Copying a file

2. Write a program to check balance parenthesis of a given program. Also generate the error report.

3. Write a program to create symbol table for a given assembly language program.

4. Write a program to create symbol table for a given high-level language program.

5. Implementation of single pass assembler on a limited set of instructions.

6. Exploring various features of debug command.

7. Use of LAX and YACC tools.

Fifth Semester

BTCS 501 Computer Networks –II

Objectives: The objective of the course is to offer good understanding of the concepts of network security, wireless, Adhoc and various emerging network technologies.

Course Contents:

1. **Network Security**: Fundamentals of network security, Basics of IPv6, IPsec: overview of IPsec, IP and IPv6, Authentication header (AH), Encapsulating Security Payload (ESP). [6]
2. **Internet Key Exchange (IKE):** History, Photuris, Simple Key-management for Internet protocols (SKIP), IKE phases, IKE encoding. [6]
3. **Adhoc networks**: Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. [6]
4. **Wireless Communication Systems**: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA. [6]
5. **3G wireless networks**: wireless local loop (WLL), Local Multipoint Distribution System (LMDS), Wireless local Area Networks (WLANs), Bluetooth and Personal Area Networks. [6]
6. **Wireless System Design:** Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems. [6]

Suggested Readings/Books:

1. Theodore S. Rappaport, Wireless Communication: Principles and Practices (2nd Edition), Pearson Education.
2. Charlie Kaufman, Radio Perlman, Mike Speciner, Neywork security, 2nd ed., PHI.
3. Sunilkumar S. Manvi, Mahabaleshwar S. Kakkasageri, Wireless and mobile networks: concepts and protocols, Wiley India.
4. Michael A. Gallo & William M. Hancock, “Computer Communications and Networking Technologies”, Cengage Learning / Thomson Brooks / Cole
5. S. Keshav, “An Engineering Approach to Computer Networking“, Pearson Education.
6. Mayank Dave, “Computer Networks”, Cengage Learning

BTCS 502 Relational Database Management System-I

Objectives: This course offers a good understanding of database systems concepts and prepares the student to be in a position to use and design databases for different applications.

Introduction to Database Systems:

File Systems Versus a DBMS, Advantages of a DBMS, Describing and Storing Data in a DBMS, Database System Architecture, DBMS Layers, Data independence. [6]

Physical Data Organization:

File Organization and Indexing, Index Data Structures, Hashing, B-trees, Clustered Index, Sparse Index, Dense Index, Fixed length and Variable Length Records.[6]

Data Models:

Relational Model, Network Model, Hierarchical Model, ER Model: Entities, Attributes and Entity Sets, Relationships and Relationship Sets, Constraints, Weak Entities, Class Hierarchies, Aggregation, Conceptual Database Design with the ER Model, Comparison of Models.[5]

The Relational Model:

Introduction to the Relational Model, ER to Relational Model Conversion, Integrity Constraints over Relations, Enforcing Integrity Constraints, Relational Algebra, Relational Calculus, Querying Relational Data.[5]

Relational Query Languages:

SQL: Basic SQL Query, Creating Table and Views, SQL as DML, DDL and DCL, SQL Algebraic Operations, Nested Queries, Aggregate Operations, Cursors, Dynamic SQL, Integrity Constraints in SQL, Triggers and Active Database, Relational Completeness, Basic Query Optimization Strategies, Algebraic Manipulation and Equivalences.[7]

Database Design:

Functional Dependencies, Reasoning about Functional Dependencies, Normal Forms, Schema Refinement, First, Second and Third Normal Forms, BCNF, Multi-valued Dependency, Join Dependency, Fourth and Fifth Normal Forms, Domain Key Normal Forms, Decompositions.[5]

Transaction Management:

ACID Properties, Serializability, Two-phase Commit Protocol, Concurrency Control, Lock Management, Lost Update Problem, Inconsistent Read Problem , Read-Write Locks, Deadlocks Handling, 2PL protocol.[6]

Database Protection:

Threats, Access Control Mechanisms, Discretionary Access Control, Grant and Revoke, Mandatory Access Control, Bell LaPadula Model, Role Based Security, Firewalls, Encryption and Digital Signatures.[5]

Suggested Readings/Books:

1. Ramez Elmasri, Shamkant Navathe ,Fundamentals of Database Systems, Fifth Edition, Pearson Education, 2007.
2. C.J. Date , An Introduction to Database Systems, Eighth Edition, Pearson Education
3. Alexis Leon, Mathews Leon , Database Management Systems, Leon Press.
4. S. K. Singh, Database Systems Concepts, Design and Applications, Pearson Education.

5. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Tata McGraw-Hill.
6. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Tata McGraw-Hill.

BTCS 503 Design & Analysis of Algorithms

Objective: To learn the ability to distinguish between the tractability and intractability of a given computational problem. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

Prerequisites: Data Structures

Introduction. What is an algorithm ? Time and space complexity of an algorithm. Comparing the performance of different algorithms for the same problem. Different orders of growth. Asymptotic notation. Polynomial vs. Exponential running time.

Basic Algorithm Design Techniques. Divide-and-conquer, greedy, randomization, and dynamic programming. Example problems and algorithms illustrating the use of these techniques.

Graph Algorithms. Graph traversal: breadth-first search (BFS) and depth-first search (DFS). Applications of BFS and DFS. Topological sort. Shortest paths in graphs: Dijkstra and Bellman-Ford. Minimum spanning trees.

Sorting and searching. Binary search in an ordered array. Sorting algorithms such as Merge sort, Quick sort, Heap sort, Radix Sort, and Bubble sort with analysis of their running times. Lower bound on sorting. Median and order statistics.

NP-completeness. Definition of class NP. NP-hard and NP-complete problems. 3SAT is NP-complete. Proving a problem to be NP-complete using polynomial-time reductions. Examples of NP-complete problems.

Coping with NP-completeness. Approximation algorithms for various NP-complete problems.

Advanced topics. Pattern matching algorithms : Knuth-Morris-Pratt algorithm. Algorithms in Computational Geometry : Convex hulls. Fast Fourier Transform (FFT) and its applications. Integer and polynomial arithmetic. Matrix multiplication : Strassen's algorithm.

Suggested Readings/Books:

1. Algorithm Design by J. Kleinberg and E. Tardos.
2. Introduction to Algorithms by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein.
3. Algorithms by S. Dasgupta, C.H. Papadimitriou, and U.V. Vazirani.
4. Algorithm Design: Foundations, Analysis, and Internet Examples by Michael T. Goodrich and Roberto Tamassia.
5. The Design and Analysis of Computer Algorithms by A. V. Aho, J. E. Hopcroft, and J. D. Ullman.
6. The Art of Computer Programming, Volumes 1, 2, and 3, by Donald Knuth.

BTCS 504 Computer Graphics

OBJECTIVES:

Understanding the fundamental graphical operations and the implementation on computer, Get a glimpse of recent advances in computer graphics, Understanding user interface issues that make the computer easy for the novice to use.

COURSE CONTENTS:

1. **Introduction**: Computer Graphics and its applications, Elements of a Graphics, Graphics Systems: Video Display Devices, Raster Scan Systems, Random Scan Systems, Input devices.
2. **Basic Raster Graphics**: Scan conversion- Point plot technique, Line drawing, Circle generating and Ellipse generating algorithms.
3. **Two-dimensional Geometric Transformations** : Basic Transformations-Translation, Rotation and Scalling, Matrix Representation and Homogeneous Coordinates, Composite Transformations, Reflection and Shearing transformations.
4. **Clipping:** Window to viewport transformation, Clipping Operations- Point Clipping, Line Clipping, Polygon Clipping and Text Clipping.
5. **Filling Techniques**: Scan line algorithms, Boundary-fill algorithm, Flood-fill algorithm, Edge fill and fence fill algorithms,
6. **Elementary 3D Graphics**: Plane projections and its types, Vanishing points, Specification of a 3D view.
7. **Visibility**: Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.
8. **Advance Topics**: Introduction of Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

Suggested Readings/Books:

1. Donald Hearn and M.Pauline Baker, **"Computer Graphics", Second Edition,** PHI/Pearson Education.

2. Zhigand xiang, Roy Plastock, Schaum's outlines, **"Computer Graphics Second Edition",** Tata Mc-Grawhill edition.

3. C, Foley, VanDam, Feiner and Hughes, **"Computer Graphics Principles & Practice"**, **Second Edition**, Pearson Education

BTCS 505 Computer Peripherals and Interfaces

OBJECTIVES: To learn the functional and operational details of various peripheral devices.

1. **SYSTEM RESOURCES**: Interrupt, DMA Channel, I/O Port Addresses and resolving and resolving the conflict of resources. I/O buses- ISA, EISA, Local bus, VESA Local bus, PCI bus, PCI Express, Accelerated graphics port bus.

2. **IDE & SCSI Interfaces**: IDE origin, IDE Interface ATA standards ATA1 to ATA7. ATA feature, ATA RAID and SCSI RAID, SCSI Cable and pin Connector pin outs SCSI V/s IDE Advantages and limitation.

3. **Video Hardware** : Video display technologies, DVI Digital signals for CRT Monitor,LCD Panels, Video adapter types, Integrated Video/ Motherboard chipset, Video RAM,Video driver and multiple Monitor, Graphic accelerators. Advanced 3D Technologies,TV Tuner and Video Capture upgrades troubleshooting Video Cards and Drivers.

4. **I/O Interfaces:** I/O Interfaces from USB and IEEE1394, I/O Interface from serial and Parallel to IEEE1394 and USB 961, Parallel to SCSI converter. Testing of serial andparallel port, USB Mouse/ Keyboard Interfaces.

5. **Input/ Output Driver software aspects:** Role of device driver DOS and UNIX/ LINUX device drivers.

6. Design & Integration of Peripheral devices to a computer system as a Case Study

7. **Future Trends:** Detailed Analysis of recent Progress in the Peripheral and Bus systems. Some aspects of cost Performance analysis while designing the system

Suggested /Readings / Books

1. Douglas V. Hall ,**“Microprocessors and Interfacing”,** Tata McGraw Hill 2006.
2. Barry B. Brey & C.R.Sarma**” The intel microprocessors,”** Pearson 2003.
3. P. Pal Chandhari , **“Computer Organization and design”** Prentice Hall of India Pvt. Ltd, 1994.
4. Del Corso, H.Kirrman, JD Nicond **“Microcomputer buses & links”** Academic Press 1986.

BTCS 506 RDBMS LAB

Note: This practical will enable students to retrieve data from relational databases using SQL. Students will also learn about triggers, cursors, stored procedures etc.

1. Introduction to SQL and installation of SQL Server / Oracle.

2. Data Types, Creating Tables, Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statements.

3. Working with Null Values, Matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statements.

4. Set Operators, Nested Queries, Joins, Sequences.

5. Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.
6. PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters.
7. Stored Procedures and Exception Handling.
8. Triggers and Cursor Management in PL/SQL.

Suggested Tools – MySQL, DB2, Oracle, SQL Server 2012, Postgre SQL, SQL lite

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BTCS 507 Computer Networks – II LAB

1. To configure the IP address for a computer connected to LAN and to configure network parameters of a web browser for the same computer.
2. To plan IPv6 address scheme for a local area network comprising of 'n' terminals.
3. To develop programs for implementing / simulating routing algorithms for Adhoc networks.
4. To install any one open source packet capture software like wireshark etc.
5. To configure Wireless Local Loop.
6. To plan Personal Area Network.
7. To configure WLAN.
8. To configure Adhoc networks.
9. To install and configure wireless access points.

BTCS 508 Design & Analysis of Algorithms Lab

Objective: To get a first-hand experience of implementing well-known algorithms in a high-level language. To be able to compare the practical performance of different algorithms for the same problem.

1. Code and analyze to compute the greatest common divisor (GCD) of two numbers.
2. Code and analyze to find the median element in an array of integers.
3. Code and analyze to find the majority element in an array of integers.
4. Code and analyze to sort an array of integers using Heap sort.
5. Code and analyze to sort an array of integers using Merge sort.
6. Code and analyze to sort an array of integers using Quick sort.
7. Code and analyze to find the edit distance between two character strings using dynamic programming.

8. Code and analyze to find an optimal solution to weighted interval scheduling using dynamic programming.
9. Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.
10. Code and analyze to do a depth-first search (DFS) on an undirected graph. Implementing an application of DFS such as (i) to find the topological sort of a directed acyclic graph, OR (ii) to find a path from source to goal in a maze.
11. Code and analyze to do a breadth-first search (BFS) on an undirected graph. Implementing an application of BFS such as (i) to find connected components of an undirected graph, OR (ii) to check whether a given graph is bipartite.
12. Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.
13. Code and analyze to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm.
14. Code and analyze to find the minimum spanning tree in a weighted, undirected graph.
15. Code and analyze to find all occurrences of a pattern P in a given string S.
16. Code and analyze to multiply two large integers using Karatsuba algorithm.
17. Code and analyze to compute the convex hull of a set of points in the plane.
18. (Mini-project Topic) Program to multiply two polynomials using Fast Fourier Transform (FFT).

BTCS 509 Computer Graphics Lab

1. To plot a point (pixel) on the screen.
2. To draw a straight line using DDA Algorithm.
3. To draw a straight line using Bresenham's Algorithm.
4. Implementation of mid-point circle generating Algorithm.
5. Implementation of ellipse generating Algorithm.
6. To translate an object with translation parameters in X and Y directions.
7. To scale an object with scaling factors along X and Y directions.
8. To rotate an object with a certain angle about origin.
9. Perform the rotation of an object with certain angle about an arbitrary point.
10. To perform composite transformations of an object.
11. To perform the reflection of an object about major axis.

12. To clip line segments against windows using Cohen Sutherland Algorithm.
13. Perform the polygon clipping against windows using Sutherland Hodgeman technique.
14. Fill a rectangle with a specified color using scan line algorithm.
15. Implementation of flood-fill and boundary-fill algorithms.

BTCS 510 Industrial Training

Sixth Semester

BTCS 601 Simulation and Modeling

Objectives: This course should provide the students with good understanding of various techniques of Simulation.

Module1: Introduction- When simulation is appropriate and when not, advantages and disadvantages of simulation, application areas in communication, computer and software design, systems and systems environment, components of a system, discrete and continuous systems, model of a system, types of models, discrete-event simulation, steps in a simulation study. Simulation Examples- Simulation of queueing systems, on-demand and inventory systems, simulation for reliability analysis etc

Module 2: General Principles- Concepts in discrete event simulation: event scheduling/time advance algorithms, world views. List Processing: properties and operations, data structures and dynamic allocation, techniques;

Module 3: Simulation Software- Integrated environments. Examples and review of some existing software popular and useful in the industry, e.g., Arena, AutoMod, Extend, Flexsim, Micro Saint, ProModel, Quest, SIMUL8, WITNESS etc. Simulation using languages and environments like C++/Java/GPSS/SSF etc. Experimentation and Statistical-Analysis Tools: common features and relevant current products.

Module 4: Statistical Models in Simulation- Terms and concepts. Statistical Models. Review of discrete and continuous distributions. Review of Poisson (stationary and non-stationary) processes. Empirical Distributions; Elementary Queueing Theory- Basic Structure of Queueing Models. Input Source (Calling Population). Queue, Queue Discipline, Service Mechanisms. Notations and relationships between *L, W, Lq*, and *Wq*. Little's Formula. Role of Exponential Distribution and Properties. Birth and Death Processes. M/M/s queues. Finite queue variation in M/M/s/K models with different s values. Finite Calling Population cases. Queueing Models involving Non-Exponential Distributions: M/G/1, M/D/s, M/Ek/s (involving Erlang distribution), Models without a Poisson Input, Models involving hyperexponential distributions, Priority Discipline Queueing Models: Preemptive and Non- Preemptive with results, properties and server number variations, Queueing Networks:Equivalence Property. Infinite Queues in Series and Product Form Solutions. Jackson Networks,

Module 5: Application of Queueing Models- Review of Characteristics (calling population system capacity, arrival processes, behavior and disciplines, service times and mechanisms etc) and notations, Application of Long-Run Measures of Performance: Time average in system, average time spent per customer, Little's Formula and server utilization, costs. Steady State behaviour of Infinite (M/G/1, M/M/c/infinity, M/M/c/N/infinity) and finite (M/M/c/K/K) Calling Population Models, Use of Network of Queues.

Module 6: Random Number Generation- Properties. Generation of Pseudo-Random Numbers, Techniques for Generation of Pseudo-Random Numbers: Linear Congruential, Combined Linear Congruential, Random Number Streams. Tests for Random Numbers: Frequency Tests and Tests for Autocorrelation. Random Variate Generation- Inverse Transform Techniques for Exponential, Uniform, Weibull, Triangular and for Empirical Continuous Distributions. Acceptance-Rejection Techniques for Poisson (Stationary and Non-Stationary) Distribution and Gamma Distribution. Special Properties like the Direct Transformation for the Normal and Lognormal Distributions, Convolution Method and others.

Module 7: Input Modeling- Data collection, Identifying the Distribution with Data: Histograms, Selection of the Appropriate Family of Distributions, Quantile-Quantile Plots.100 Parameter Estimation: Sample Mean and Sample Variance and various biased and unbiased Estimators. Goodness of Fit Tests applied to

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Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, p-Values and Best Fits.Verification and Validation of Simulation Models- Verification and Validation of Simulation Models. Calibration and Validation: Face Validity, Validation of Assumptions, Input-Out Transformation Validation.

Module 8: Output Analysis of a Single Model- Output analysis and types of simulation. Stochastic Nature of the Output Data. Measures of Performance and Estimation: Point Estimation and Confidence-Interval Estimation. Output Analysis for Terminating Simulations and Estimation of Probabilities. Output Analysis of Steady State Simulations: Initialization Bias, Error Estimation, Replications, Sample Size and Batch Means for Interval Estimation.

Module 9: Comparison and Evaluation of Alternative System Designs- Comparison of Two System Designs.; Sampling with Equal and Unequal Variances. Common Random Numbers. Confidence Intervals with Specified Precision. Comparison of Several System Designs: Bonferroni Approaches to Multiple Comparisons and to Screening and to Selection of the Best. MetamodelingL Sample Linear Regression, Testing for Significance, Multiple Linear Regression. Random Number Assignment for Regression. Optimization via Simulation: Robust Heuristics.

Module10: Simulation of Computer Systems- Simulation Tools: Process Orientation and Event Orientation. Model Input: Modulated Poisson Process and Virtual-Memory Referencing. High-Level Simulation. CPU and Memory Simulations. Simulation of Computer Networks- Traffic Modeling, Media Access Control: Token-Passing Protocols and Ethernet, Data Link Layer, TCP, Model Construction.

Simulation Languages: Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.

Suggested Readings/ Books:

1. 1.Jerry Banks, John S. Carson II, Barry L. Nelson and David M. Nicol, *Discrete-Event System and Simulation,* Prentice Hall of India, New Delhi, 2005
2. Averill M. Law, *Simulation modeling and analysis (SIE),* Tata McGraw Hill India, 2007
3. David Cloud, Larry Rainey, A*pplied Modeling and Simulation,* Tata McGraw Hill, India.
4. Gabriel A. Wainer, *Discrete-event modeling and simulation: a practitioner's approach,* CRC Press, 2009.
5. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, *Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems,* Academic Press, 2000.
6. Walter J. Karplus, George A. Bekey, Boris Yakob Kogan, *Modeling and simulation: theory and practice,* Springer, 2003.
7. Stanislaw Raczynski, *Modeling and simulation: the computer science of illusion,* Wiley, 2006.
8. Mohammad Salameh Obaidat, Georgios I. Papadimitriou, *Applied system simulation: methodologies and application,* Springer, 2003.
9. van Dijk, Nico M.; Boucherie, Richard J. (Eds.) 2011. *Queueing Networks: A Fundemental Approach*. 798 p. 148 illus. Springer.
10. Bhat, U. Narayan, *An Introduction to Queueing Theory: Modeling and Analysis in Applications,* Springer 2008 (Birkhäuser Boston).
11. James J. Nutaro, *Building software for simulation: theory and algorithms, with applications in C++.* Wiley, 2010.

BTCS 602 RDBMS–II

Objectives: This course offers a good understanding of advanced database concepts and technologies. It prepares the student to be in a position to use and design databases for a variety of applications.

Introduction to Database Systems: Database System Concepts and Architecture, Data Models, Data Independence, SQL: DDL, DML, DCL, Normalization: 1NF, 2NF, 3NF, BCNF, 4NF, 5NF. (6)

Query Processing and Optimization:
Query Processing, Syntax Analyzer, Query Decomposition, Query Optimization, Heuristic Query Optimization, Cost Estimation, Cost Functions for Select, Join, Query Evaluation Plans. (6)

Transaction Processing and Concurrency Control:
Transaction Processing Concepts, Concurrency Control Techniques: Two-phase Locking, Timestamp Ordering, Multiversion, Validation, Multiple Granularity Locking. (5)

Object Oriented and Object Relational Databases:
Object Oriented Concepts, Object Oriented Data Model, Object Definition Language, Object Query Language, Object Relational Systems, SQL3, ORDBMS Design. (5)

Distributed Databases:
Distributed Database Concepts, Advantages and Disadvantages, Types of Distributed Database Systems, Data Fragmentation, Replication and Allocation Techniques for Distributed Database Design, Five Level Schema Architecture, Query Processing, Concurrency Control and Recovery in Distributed Databases. (6)

Backup and Recovery:
Types of Database Failures, Types of Database Recovery, Recovery Techniques: Deferred Update, Immediate Update, Shadow Paging, Checkpoints, Buffer Management. (5)

Introduction to Data Warehousing and Data Mining:
Introduction to OLAP, OLTP, Data Warehouse, Data Marts, Data Mining, Data Mining Process, Big Data. (5)

Enterprise Database Products:
Enterprise Database Products, Familiarity with IBM DB2 Universal Database, Oracle, Microsoft SQL Server, MySQL, their features. (7)

Suggested Readings/ Books:

1. Ramez Elmasri, Shamkant Navathe, Fundamentals of Database Systems, Fifth Edition, Pearson

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Education, 2007.
2. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, Tata McGraw-Hill.
3. C.J. Date, An Introduction to Database Systems, Eighth Edition, Pearson Education.
4. Alexis Leon, Mathews Leon, Database Management Systems, Leon Press.
5. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Database System Concepts, Tata McGraw-Hill.
6. S. K. Singh, Database Systems Concepts, Design and Applications, Pearson Education.
7. Chris Eaton, Paul Zikopoulos, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data

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BTCS 603 Software Engineering

Module1: Evolution and impact of Software engineering, software life cycle models: Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.

Module2: Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.

Module3: Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling.

Module4: Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management, ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

Suggested Readings/ Books:

1. Roger Pressman, **"Software Engineering: A Practitioners Approach,**(6th Edition), McGraw Hill, 1997.
2. Sommerville,"**Software Engineering, 7th edition**", Adison Wesley, 1996.
3. Watts Humphrey,**" Managing software process**", Pearson education, 2003.
4. James F. Peters and Witold Pedrycz, **" Software Engineering – An Engineering Approach"**, Wiley.
5. Mouratidis and Giorgini. **"Integrating Security and Software Engineering–Advances and Future"**, IGP. ISBN – 1-59904-148-0.
6. Pankaj Jalote, **"An integrated approach to Software Engineering"**, Springer/Narosa.

Elective-I

BTCS 901 Web Technologies (Elective-I)

INTERNET AND WORLD WIDE WEB: Introduction, Internet Addressing, ISP, types of Internet Connections, Introduction to WWW, WEB Browsers, WEB Servers, URLS, http, WEB applications, Tools for WEB site creation. (4)

HTML: Introduction to HTML, Lists, adding graphics to HTML page, creating tables, linking documents, frames, DHTML and Style sheets. (6)

Java Script: Introduction, programming constructs: variables, operators and expressions, conditional checking, functions and dialog boxes, JavaScript DOM, creating forms, introduction to Cookies

JAVA: Introduction to java objects and classes, control statements, arrays, inheritance, polymorphism, Exception handling. (6)

XML: Why XML, XML syntax rules, XML elements, XML attributes, XML DTD displaying XML with CSS. (6)

AJAX : Introduction, HTTP request, XMHttpRequest, AJAX Server Script, AJAX Database.

PHP: Introduction, syntax, statements, operators, sessions, E-mail, PHP and MySQL, PHP and AJAX.

Suggested Readings/Books:

1. Deitel,Deitel, Nieto, and Sandhu: XML How to Program, Pearson Education.
2. Herbert Schildt: Java 2: The Complete Reference, Fifth Edition, TMH
3. Ivan Bayross: Web Enabled Commercial Application
4. Schafer: Development, BPB
5. HTML,CSS, JavaScript,Perl, Python and PHP, Wiley India Textbooks.

BTCS 902 Mobile Applications Development (Elective-I)

Unit I:

Introduction: Mobile operating system, Operating system structure, Constraints and Restrictions, Hardware configuration with mobile operating system, Features: Multitasking Scheduling, Memory Allocation, File System Interface, Keypad Interface, I/O Interface, Protection and Security, Multimedia features.

Unit II:

Introduction to Mobile development IDE's, Introduction to Worklight basics, Optimization, pages and fragments , Writing a basic program- in Worklight Studio, Client technologies, Client side debugging, Creating adapters, Invoking adapters from Worklight Client application, Common Controls, Using Java in adapters, Programming exercise with Skins, Understanding Apache Cordova, Offline access, Encrypted cache deprecated, Using JSONStore

Unit III:

Understanding Apple iOS development, Android development, Shell Development, Creating Java ME application, Exploring the Worklight Server, Working with UI frameworks, Authentication, Push notification, SMS Notifications, Globalization, WebView overlay , Creating Authentication application: development for Apple iOS by using a login module, Device Analytics, Worklight Server Administration

Unit IV:

Windows Phone: Introduction to Windows Phone, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Unit V:

Android: Introduction to Android, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Unit VI:

iOS: Introduction to iOS, Architecture, memory management, communication protocols, application development methods, deployment.
Case Study: Design and development of Application using mobile application development platforms e.g. WorkLight, Kendo, Appcon, Xcode, Xpages

Suggested Readings/Books:

1. Anubhav Pradhan, Anil V Deshpande, " Mobile Apps Development" Edition: I
2. Jeff McWherter, Scott Gowell "Professional Mobile Application Development", John Wiley & Sons, 2012.
3. Barry Burd, "Android Application Development All in one for Dummies", Edition: I
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS
5. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons
6. Henry Lee, Eugene Chuvyrov, "Beginning Windows Phone App Development", Apress, 2012.
7. Jochen Schiller,"Mobile Communications", Addison-Wesley, 2nd edition, 2004.
8. Stojmenovic and Cacute, "Handbook of Wireless Networks and Mobile Computing", Wiley, 2002, ISBN 0471419028.
9. Worklight resources

BTCS 903 Ethical Hacking (Elective-I)

Introduction: Understanding the importance of security, Concept of ethical hacking and essential Terminologies-Threat, Attack, Vulnerabilities, Target of Evaluation, Exploit. Phases involved in hacking

Foot printing: Authoritative, Non -Auth reply by DNS, Introduction to foot printing, Understanding the information gathering methodology of the hackers, Tools used for the reconnaissance phase.

Scanning: Detecting live systems on the target network, Discovering services running /listening on target systems, Understanding port scanning techniques, Identifying TCP and UDP services running on the target network, Understanding active and passive fingerprinting.

System Hacking: Aspect of remote password guessing, Role of eavesdropping ,Various methods of password cracking, Keystroke Loggers, Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

Hacking Wireless Networks: Introduction to 802.11,Role of WEP, Cracking WEP Keys, Sniffing Traffic, Securing Wireless Networks.

Cryptography: Understand the use of Cryptography over the Internet through PKI, RSA, MD-5, Secure Hash Algorithm and Secure Socket Layer.

Suggested Readings/Books:

1. Network Security and Ethical Hacking, Rajat Khare , Luniver Press
2. Ethical Hacking, Thomas Mathew ,OSB Publisher
3. Hacking Exposed: Network Security Secrets & Solutions, Stuart McClure, Joel Scambray and George Kurtz, McGraw-Hill

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BTCS 904 Information Security (Elective-I)

Objectives: Upon completion of this course, students will have gained knowledge of information security concepts and understanding of Information Security principles and approaches.

Module1: Symmetric Ciphers - Overview: Services, Mechanisms and Attacks, The OSI Security Architecture, A Model of Network Security. Classicial Encryption Techniques: Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, Rotor Machines, Steganography. Block Cipher and the Data Encryption Standard: Simplified DES, Block Cipher Principles, The DES, The Strength of DES, Differential and Linear Cryptanalysis. Symmetric Ciphers: Triple DES, Blowfish. Confidentiality using Conventional Encryption: Placement of Encryption Function, Traffic Confidentiality, Key Distribution, Random Number Generation.

Module2: Public Key Encryption, Digital Signatures - Number Theory, Prime Numbers Format□s and Euler□s Theorems, Testing for Primality. Public Key Cryptography and RSA: Principles of Public Key Cryptosystems, The RSA Algorithms, Key Management, Diffie Hellman Key Exchange.

Module3: Authentication Protocols - Message Authentication: Authentication Requirements, Authentication Functions, Message Authentication Codes, MD5 Message Digest Algorithms, Digital Signatures and Authentication Protocols: Digital Signatures, Authentication Protocols, Digital Signature Standards.

Module4: Network Security - Authentication Applications: Kerberos, X.509 Directory Authentication Service. Electronic Mail Security: Pretty Good Privacy. IP Security: Overview, IP Security Architecture, Authentication Header, Encapsulation Security Payload. Web Security: Web Security Requirements, Secure Sockets Layer and Transport Layer Security, Secure Electronic Transaction.

Module5: System Security- Intruders, Malicious Software, Viruses and Related Threats, Counter Measures, Firewalls and its Design Principles.

Suggested / Readings & Books

1. William Stallings, Network Security Essentials, Applications and Standards Pearson Education.
2. William Stallings, Cryptography and Network Security Principles and practice. 2/e,Pearson Education.
3. Bishop, Matt, Introduction to Computer Security. Addison-Wesley, Pearson Education, Inc. ISBN: 0-321-24744-2. (2005)
4. Michael. E. Whitman and Herbert J. Mattord Principles of Information Security, Cengage Learning

5. Atul Kahate Cryptography & Network Security, TMH, 2^{nd} Edition
6. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in Public World, 2nd Edition, 2011, Pearson Education.

BT*** Open Elective

BTCS 604 RDBMS-II Lab

1. Case studies on normalization
2. Study and usage of query optimization techniques
3. Study and usage of backup and recovery features of database management software
4. Server administration of any database management software
5. Study and usage of any object oriented or object relational database management software
6. Study and usage of open source data mining tool: Weka
7. Study of web databases
8. Development of a project by making use of tools studied above

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BTCS 605 Free/Open Source Software Lab

Students will be doing the practicals related to the **Elective-I** opted by them by using open source technologies available in the area of the subject.

BTCS 606 Software Engineering Lab

1. Study and usage of OpenProj or similar software to draft a project plan
2. Study and usage of OpenProj or similar software to track the progress of a project
3. Preparation of Software Requirement Specification Document, Design Documents and Testing Phase related documents for some problems
4. Preparation of Software Configuration Management and Risk Management related documents
5. Study and usage of any Design phase CASE tool
6. To perform unit testing and integration testing
7. To perform various white box and black box testing techniques
8. Testing of a web site

Suggested Tools - Visual Paradigm, Rational Software Architect. Visio, Argo UML, Rational Application Developer etc. platforms.

BTCS 607 Simulation and Modeling Lab

1. **Programming in MATLAB:** Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
2. Introduction regarding usage of any Network Simulator.
3. Practical Implementation of Queuing Models using C/C++.

Seventh/Eighth Semester

BTCS 701 Artificial Intelligence

Module1: Introduction- What is intelligence? Foundations of artificial intelligence (AI). History of AI; Problem Solving- Formulating problems, problem types, states and operators, state space, search strategies.

Module2: Informed Search Strategies- Best first search, A* algorithm, heuristic functions, Iterative deepening A*(IDA), small memory A*(SMA); Game playing - Perfect decision game, imperfect decision game, evaluation function, alpha-beta pruning

Module3: Reasoning-Representation, Inference, Propositional Logic, predicate logic (first order logic), logical reasoning, forward chaining, backward chaining; AI languages and tools - Lisp, Prolog, CLIPS

Module4: Planning- Basic representation of plans, partial order planning, planning in the blocks world, heirarchical planning, conditional planning, representation of resource constraints, measures, temporal constraints

Module5: Uncertainty - Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic; Decision making- Utility theory, utility functions, Decisiontheoretic expert systems.

Module 6: Inductive learning - decision trees, rule based learning, current-best-hypothesis search, least-commitment search , neural networks, reinforcement learning, genetic algorithms; Other learning methods - neural networks, reinforcement learning, genetic algorithms.

Module7: Communication - Communication among agents, natural language processing, formal grammar, parsing, grammar

Suggested / Readings & Books

1. Stuart Russell and Peter Norvig. *Artificial Intelligence – A Modern Approach,* Pearson Education Press, 2001.
2. Kevin Knight, Elaine Rich, B. Nair, *Artificial Intelligence, McGraw Hill, 2008.*
3. George F. Luger, *Artificial Intelligence,* Pearson Education, 2001.
4. Nils J. Nilsson, *Artificial Intelligence: A New Synthesis,* Morgan Kauffman, 2002.

BTCS 702 Theory of Computation

Objectives: To give the students knowledge of number of areas in theoretical computer science and their interconnections.

Module 1: Basics of Strings and Alphabets

Module2: Finite Automata – DFA, transition graphs, regular languages, non-deterministic FA, equivalence of DFA and NDFA

Module3: Regular grammars, regular expressions, equivalence between regular languages, properties of regular languages, pumping lemma.

Module4: Context Free Languages – Leftmost and rightmost derivation, parsing and ambiguity, ambiguity in grammar and languages, normal forms

Module5: Pushdown Automata – NDPDA, DPDA, context free languages and PDA, comparison of deterministic and non-deterministic versions, closure properties, pumping lemma for CFL

Module6: Turing Machines, variations, halting problem, PCP

Module7: Chomsky Hierarchy, LR(k) Grammars, properties of LR(k) grammars, Decidability and Recursively Enumerable Languages

Suggested Readings/Books

1. K.L.P. Mishra and N. Chandrasekaran, **"Theory of Computer Science, Third Edition"**, PHI Learning Private Limited, 2011.
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, **"Introduction to Automata Theory**", Languages and Computation, Pearson Education.
3. M. Sipser, **"Introduction to the Theory of Computation"**, Second Edition, Cengage Learning.
4. K. V. N. Sunitha , N. Kalyani, **"Formal Languages and Automata Theory"**, McGraw-Hill, 2010.
5. Stephen Wolfram, **"Theory and Applications of Cellular Automata"**, World Scientific, 1986.
6. G.E. Revesz, **"Introduction to Formal Languages"**, Dover Publications, 1991.
7. M. A. Harrison, **"Introduction to Formal Language Theory"**, Addison-Wesley, 1978.
8. R.K. Shukla,**" Theory of Computation"**, Cengage Learning.
9. An Introduction to Formal Languages and Automata, by Peter Linz, Third Edition, Narosa Publishers (1998)

BTCS 703 Project

BTCS704 Artificial Intelligence Lab

1. Write A Program For DEPTH FIRST SEARCH
2. Write A Program For Best First Search
3. Write A Program to Generate the output for A* Algorithm.
4. Write a Lisp Program to solve Water Jug Problem Using Heuristic Function.
5. Write a Program To Show the Tic Tac Toe Game for 0 and X.
6. Write A Program For Expert System By Using Forward Chaining.
7. Write a program to implement tower of hanoi.
8. Write a program to implement a heuristic search procedure.
9. Write a program to implement a production system.
10. Write a program to implement search problems of 3 x 3 puzzle.

Elective-II

BTCS 905 Software Testing and Quality Assurance (Elective–II)

Objectives: This course offers a good understanding of the concepts, methods and techniques of software testing and quality assurance and prepares students to be in a position to develop error free and quality software.

Introduction: Overview of Software Engineering, Software Process, Process Models, Overview of Project Management Process and its Phases. (7)

Software Quality Assurance Concepts and Standards: Quality Concepts, Quality Control, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, Review Guidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000, ISO 9001:2000, ISO 9126 Quality Factors, CMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics. (8)

Risk Management and Change Management: Software Risks, Risk Identification, Risk Projection, Risk Refinement, The RMMM Plan, Software Configuration Management, Baselines, Software Configuration Items, SCM Process: Version Control, Change Control, Configuration Audit, Configuration Management for Web Engineering. (7)

Software Testing: Testing, Verification and Validation, Test Strategies for Conventional and Object Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha and Beta Testing, System Testing, Recovery Testing, Security Testing, Stress Testing, Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies. (7)

Testing Techniques: Software Testing Fundamentals, Black Box and White Box Testing, Basis Path Testing, Flow Graph Notation, Independent Program Paths, Graph Matrices, Control Structure Testing, Condition Testing, Data Flow Testing, Loop Testing, Graph Based Testing Methods, Equivalence Partitioning, Boundary Value Analysis. (8)

Object Oriented Testing Methods: Applicability of Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-Based Testing, Scenario-Based Testing, Random Testing and Partition Testing for Classes, InterClass Test Case Design. (8)

Testing Process and Specialized Systems Testing: Test Plan Development, Requirement Phase, Design Phase and Program Phase Testing, Testing Client/Server Systems, Testing Web based Systems, Testing Off-the-Shelf Software, Testing in Multiplatform Environment, Testing for Real Time Systems, Testing Security.

(8)

Case studies: Design test cases for: ERP, Traffic controller, University Management system etc.

Suggested Readings/Books

1. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
2. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.
3. William E. Perry, Effective Methods for Software Testing, Second Edition, John Wiley & Sons.
4. Paul C. Jorgensen, Software Testing: A Craftsman’s Approach, Third Edition, Auerbach Publications, Taylor and Francis Group, 2010.
5. Yogesh Singh, Software Testing, Cambridge University Press.

6. K.K. Aggarwal, Yogesh Singh, Software Engineering, Second Edition, New Age International.
7. Pankaj Jalote, An Integrated Approach to Software Engineering, Second Edition, Narosa.
8. S. Limaye, Software Testing, McGraw-Hill.
9. A. C. Gillies, Software Quality: Theory & Practice, Cengage Learning.
10. Graham, Foundations of Software Testing: ISTQB Certification, Cengage Learning.
11. R. Shende, Software Automation Testing Tools for Beginners, Shroff Publishers.
12. A. P. Mathur, Foundations of Software Testing, Pearson Education.

Suggested tools: XUnit/ rational functional tester.

BTCS 906 Object Oriented Analysis and Design (Elective–II)

Module1: Introduction to object oriented systems, Classes, Objects, Abstraction, Inheritance, Polymorphism, Encapsulation, Message Sending, Association, Aggregation, Iterative development and the Unified Process (UP), UP phases: Inception, Elaboration, Construction and Transition, Object-oriented metrics

Module2: Introduction to UML, Use Cases and functional requirements, Identifying and writing Use Cases, Decomposition of use cases, Modeling System Workflows using Activity Diagrams, Modeling a System's Logical Structure using Classes and Class Diagrams, Modeling Interactions using Sequence Diagrams and Communication Diagrams, Timing Diagrams, Interaction Overview Diagrams, Component Diagram, Package diagram, State Machine Diagrams, Deployment Diagrams.

Module3: Introduction to Patterns, GoF Patterns, Creational Patterns, Structural Patterns, Behavioral Patterns, Software Architectural patterns, The Observer Pattern, The Template Method Pattern , Factory Patterns: Factory Method and Abstract Factory , The Singleton Pattern , The Iterator Pattern , The Composite Pattern , The Facade Pattern , The State and Strategy patterns , Command Pattern , The Adapter Pattern , The Proxy Pattern , The Decorator Pattern, The Visitor Pattern , AntiPatterns, Patterns for Assigning Responsibilities: GRASP Patterns

Module4: Domain modeling, assigning responsibility using sequence diagrams, mapping design to code, CASE tools, Unit, Cluster, and System-level testing of Object-oriented programs, Aspect- oriented and Service-oriented software.

Suggested Readings/Books

1. Grady Booch, James Rumbaugh, Ivar Jacobson ,"The Unified Modeling Language User Guide", Pearson Education.
2. Hans-Erik Eriksson, Magnus Penker, Brian Lyons, David Fado, "UML 2 Toolkit", WILEY-Dreamtech India Pvt. Ltd.
3. Meilir Page-Jones,"Fundamentals of Object Oriented Design in UML", Pearson Education.
4. Pascal Roques, "Modeling Software Systems Using UML2", WILEY- Dreamtech India Pvt. Ltd
5. Atul Kahate, "Object Oriented Analysis & Design", The McGraw-Hill Companies.
6. John W. Satzinger, Robert B Jackson and Stephen D Burd, "Object-Oriented Analysis and Design with the Unified Process", Cengage Learning
7. Gamma, et. al., Design Patterns - Elements of Reusable Object-Oriented Software, , Addison-Wesley. (1994)
8. Craig Larman, Applying UML and Patterns: An Introduction to object-oriented Analysis and Design and iterative development, Pearson Education. (1998)

BTCS 907 Software Project Management

Objective- Software development is a complex process involving such activities as domain analysis, requirements specification, communication with the customers and end-users, designing and producing different artifacts, adopting new paradigms and technologies, evaluating and testing software products, installing and maintaining the application at the end-user's site, providing customer support, organizing end-user's training, envisioning potential upgrades and negotiating about them with the customers, and many more. The proposed subject will take students through the various processes involved in project management.

Module1: Project Evaluation and Planning - Activities in Software Project Management, Overview Of Project Planning, Stepwise planning, contract management, Software processes and process models. Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam□s equation, Capers Jones estimating rules of thumb, Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

Module2: Monitoring And Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types Of Contracts, Stages In Contract Placement, Typical Terms of A Contract, Contract Management and Acceptance.

Module3: Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behaviour, Selecting The Right Person For The Job, Motivation, The Oldman – Hackman Job Characteristics Model , Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health And Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

Suggested Readings/Books

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill. (2009)
2. Royce, “Software Project Management”, Pearson Education. (2005).
3. Robert K. Wysocki, “Effective Software Project Management”, Wiley.(2006)
4. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
5. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.
6. Kassem, Software Engineering, Cengage Learning.

Suggested Tools – Rational Team Concert, MS Project

BTCS 908 Business Intelligence

Introduction to Business Intelligence: Introduction to OLTP and OLAP, BI Definitions & Concepts, Business Applications of BI, BI Framework, Role of Data Warehousing in BI, BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities. (8)

Basics of Data Integration (Extraction Transformation Loading): Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, introduction to ETL, Introduction to data quality, data profiling concepts and applications. (8)

Introduction to Multi-Dimensional Data Modeling: Introduction to data and dimension modeling, multidimensional data model, ER Modeling vs. multi dimensional modeling, concepts of dimensions, facts, cubes, attribute, hierarchies, star and snowflake schema, introduction to business metrics and KPIs, creating cubes using SSAS. (8)

Basics of Enterprise Reporting: Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, and overall architecture. (6)

Data Mining Functionalities: Association rules mining, Mining Association rules from single level, multilevel transaction databases, Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbor classification, Cluster analysis, Types of data in clustering, categorization of clustering methods. (15)

Suggested Readings/Books

1. R N Prasad, Seema Acharya: Fundamentals of Business Analytics, Wiley India, First Edition, 2011
2. J.Han and M. Kamber: Data Mining: Concepts and Techniques By Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
3. David Loshin: Business Intelligence: The Savvy Manager's Guide., Latest Edition By Knowledge Enterprise.
4. Larissa Terpeluk Moss, Shaku Atre: Business Intelligence roadmap by Addison Weseley
5. Cindi Howson: Successful Business Intelligence: Secrets to making Killer BI Applications by Tata McGraw Hill
6. Mike Biere: Business intelligence for the enterprise by Addison Weseley, Ausgust 2010

BTCS-909 Agile Software Development

Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools (6)

Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management . (8)

Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester. (8)

Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation

Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control. (10)

Industry Trends Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies. (4)

Suggested Readings/Books:

1. Agile Software Development with Scrum By Ken Schawber, Mike Beedle Publisher: Pearson
2. Agile Software Development, Principles, Patterns and Practices By Robert C. Martin Publisher: Prentice Hall
3. Agile Testing: A Practical Guide for Testers and Agile Teams By Lisa Crispin, Janet Gregory Publisher: Addison Wesley
4. Agile Software Development: The Cooperative Game By Alistair Cockburn Publisher: Addison Wesley
5. User Stories Applied: For Agile Software By Mike Cohn

Elective-III

BTCS 910 Multimedia and Application (Elective-III)

Objectives: This Course introduces the multimedia systems and their applications to students. This course covers the different compression standards used in multimedia, some current technology and related issues.

Introduction: Multimedia and its types, Introduction to Hypermedia, Hyper Text, Multimedia Systems and their Characteristics, Challenges, Desirable Features, Components and Applications, Trends in Multimedia. (4)

Multimedia Technology: Multimedia Systems Technology , Multimedia Hardware devices, Multimedia software development tools, Multimedia Authoring Tools, Multimedia Standards for Document Architecture, SGML, ODA, Multimedia Standards for Document interchange, MHEG, Multimedia Software for different media. (6)

Storage Media: Magnetic and Optical Media, RAID and its levels, Compact Disc and its standards, DVD and its standards, Multimedia Servers. (4)

Audio: Basics of Digital Audio, Application of Digital Audio, Digitization of Sound, Sample Rates and Bit Size, Nyquist's Sampling Theorem Typical Audio Formats Delivering Audio over a Network , Introduction to MIDI (Musical Instrument Digital Interface), Components of a MIDI System Hardware Aspects of MIDI, MIDI Messages. Audio Compression, Simple Audio Compression Methods, Psychoacoustics, MPEG Audio Compression. (8)

Basics of Compression: Classifying Compression Algorithms, Lossless Compression Algorithms, Entropy Encoding, Run-length Encoding, Pattern Substitution, Basics of Information theory, Huffman Coding, Adaptive Huffman Coding, Arithmetic Coding, Lempel-Ziv-Welch (LZW) Algorithm, Source Coding Techniques: Transform Coding, Frequency Domain Methods, Differential Encoding. (6)

Image and Graphics Compression: Colour in Images, Types of Colour Models, Graphic/Image File Formats: TIFF, RIFF, BMP, PNG, PDF, Graphic/Image Data, and JPEG Compression, GIF Compression. (6)

Video Compression: Basics of Video , Video Signals, Analog Video, Digital Video, TV standards, H. 261 Compression, Intra Frame Coding, Inter-frame (P-frame) Coding, MPEG Compression, MPEG Video, The MPEG Video Bitstream , Decoding MPEG Video in Software. (6)

Multimedia Communication: Building Communication network, Application Subsystem, Transport Subsystem, QOS, Resource Management, Distributed Multimedia Systems. (5)

Suggested Readings/Books

1. Ralf Steinmetz amd Klara Nahrstedt,**" Multimedia Computing Communications and Applications"** Pearson Educations.

2. Parag Havaldar, Gerard Medioni,**"Multimedia Systems Design"**, PHI, Latest Edition

BTCS-911 Soft Computing (Elective-III)

Module1: Introduction - What is soft computing? Differences between soft computing and hard computing, Soft Computing constituents, Methods in soft computing, Applications of Soft Computing.

Module2: Introduction to Genetic Algorithms- Introduction to Genetic Algorithms (GA), Representation, Operators in GA, Fitness function, population, building block hypothesis and schema theorem.; Genetic algorithms operators- methods of selection, crossover and mutation, simple GA(SGA), other types of GA, generation gap, steady state GA, Applications of GA

Module 3: Neural Networks- Concept, biological neural system,. Evolution of neural network, McCulloch-Pitts neuron model, activation functions, feedforward networks, feedback networks, learning rules – Hebbian, Delta, Perceptron learning and Windrow-Hoff,winner-take-all.

Module 4: Supervised learning- Perceptron learning, single layer/multilayer perceptron, linear separability, hidden layers, back propagation algorithm, Radial Basis Function network; Unsupervised learning - Kohonen, SOM, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in image processing.

Module 5: Fuzzy systems **-** Basic definition and terminology, set-theoretic operations, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions, Fuzzy Rules & Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making; Neuro-fuzzy modeling- Adaptive Neuro-Fuzzy Inference Systems, Coactive Neuro-Fuzzy Modeling, Classification and Regression Trees, Data Clustering Algorithms, Rulebase Structure Identification and Neuro-Fuzzy Control , Applications of neuro-fuzzy modeling.

Module 6: Swarm Intelligence- What is swarm intelligence? Various animal behavior which have been used as examples, ant colony optimization, swarm intelligence in bees, flocks of birds, shoals of fish, ant-based routing, particle swarm optimization

Suggested Readings/Books

1. S.N. Shivanandam, *Principle of soft computing*, Wiley. ISBN13: 9788126527410 (2011)
2. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, "Neuro-Fuzzy and Soft Computing", Prentice-Hall of India, 2003.
3. George J. Klir and Bo Yuan, "Fuzzy Sets and Fuzzy Logic-Theory and Applications", Prentice Hall, 1995.
4. James A. Freeman and David M. Skapura, "Neural Networks Algorithms, Applications, and Programming Techniques", Pearson Edn., 2003.
5. Mitchell Melanie, "An Introduction to Genetic Algorithm", Prentice Hall, 1998.
6. David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, Addison Wesley, 1997.

BTCS 912 – Cloud Computing (Elective-III)

Overview of cloud computing : What is a cloud, Definition of cloud , Definition of cloud ,characteristics of cloud ,Why use clouds, How clouds are changing , How clouds are changing , Driving factors towards cloud, Comparing grid with cloud and other computing systems, workload patterns for the cloud, "Big Data", IT as a service.

Cloud computing concepts: Concepts of cloud computing, Cloud computing leverages the Internet, Positioning cloud to a grid infrastructure, Elasticity and scalability, Virtualization, Characteristics of virtualization, Benefits of virtualization, Virtualization in cloud computing, Hypervisors, Multitenancy, Types of tenancy, Application programming interfaces (API), Billing and metering of services , Economies of scale, Management, tooling, and automation in cloud computing, Management: Desktops in the Cloud, Security.

Cloud service delivery: Cloud service , Cloud service model architectures, Infrastructure as a service (IaaS) architecture, Infrastructure as a service (IaaS) details, Platform as a service (PaaS) architecture, Platform as a service (PaaS) details, Platform as a service (PaaS) , Examples of PaaS software, Software as a service (SaaS) architecture, Software as a service (SaaS) details, Examples of SaaS applications, Trade-off in cost to install versus , Common cloud management platform reference architecture: Architecture overview diagram, Common cloud management platform.

Cloud deployment scenarios: Cloud deployment models, Public clouds, Hybrid clouds, Community, Virtual private clouds, Vertical and special purpose, Migration paths for cloud, Selection criteria for cloud deployment.

Security in cloud computing : Cloud security reference model, How security gets integrated , Cloud security , Understanding security risks, Principal security dangers to cloud computing, Virtualization and multitenancy, Internal security breaches, Data corruption or loss, User account and service hijacking, Steps to reduce cloud security breaches, Steps to reduce cloud security breaches, Reducing cloud security, Identity management: Detection and forensics, Identity management: Detection and Identity management, Benefits of identity, Encryption techniques, Encryption & Encrypting data , Symmetric key encryption, Asymmetric key encryption, Digital signature, What is SSL?

IBM Smart Cloud, Amazon Web Services, Google Cloud platform, Windows Azure platform, A comparison of Cloud Computing Platforms, Common building Blocks.

Suggested Readings/Books

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, Cloud Computing: Principles and paradigms, 2011
2. Michael Miller, Cloud Computing, 2008.
3. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, Cloud Computing for dummies, 2009.
4. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, Cloud Computing: A practical Approach, McGraw Hill, 2010.
5. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.
6. Borko Furht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.

BTCS 913 Compiler Design (Elective-III)

Objectives: This course will provide the in-depth knowledge of different concepts involved while designing a compiler.

Module1: Overview of compilation- The structure of a compiler and applications of compiler technology; Lexical analysis - The role of a lexical analyzer, specification of tokens, recognition of tokens, hand-written lexical analyzers, LEX, examples of LEX programs.

Module2: Introduction to syntax analysis -Role of a parser, use of context-free grammars (CFG) in the specification of the syntax of programming languages, techniques for writing grammars for programming languages (removal left recursion, etc.), non- context-free constructs in programming languages, parse trees and ambiguity, examples of programming language grammars.

Module3: Top-down parsing- FIRST & FOLLOW sets, LL(1) conditions, predictive parsing, recursive descent parsing, error recovery. LR-parsing - Handle pruning, shift-reduce parsing, viable prefixes, valid items, LR(0) automaton, LR-parsing algorithm, SLR(1), LR(1), and LALR(1) parsing. YACC, error recovery with YACC and examples of YACC specifications.

Module 4: Syntax-directed definitions (attribute grammars)-Synthesized and inherited attributes, examples of SDDs, evaluation orders for attributes of an SDD, dependency graphs. S-attributed and L-attributed SDDs and their implementation using LR-parsers and recursive descent parsers respectively.

Module5: Semantic analysis- Symbol tables and their data structures. Representation of “scope”. Semantic analysis of expressions, assignment, and control-flow statements, declarations of variables and functions, function calls, etc., using S- and L-attributed SDDs (treatment of arrays and structures included). Semantic error recovery.

Module6: Intermediate code generation - Different intermediate representations –quadruples, triples, trees, flow graphs, SSA forms, and their uses. Translation of expressions (including array references with subscripts) and assignment statements. Translation of control-flow statements – it- then-else, while-do, and switch. Short-circuit code and control-flow translation of Boolean expressions. Back patching. Examples to illustrate intermediate code generation for all constructs.

Module 7: Run-time environments:- Stack allocation of space and activation records. Access to non-local data on the stack in the case of procedures with and without nesting of procedures.

Module 8: Introduction to machine code generation and optimization- Simple machine code generation, examples of machine-independent code optimizations.

Suggested Readings/Books

1. Aho, Ullman:Principles of Compiler Design. Narosa Publication.
2. Dhamdhere:Compiler Construction- Principles and Practice ,Macmillan, India
3. K.D. Cooper, and Linda Torczon, Engineering a Compiler, Morgan Kaufmann, 2004.
4. Holub:Compiler Design in C, PHI.
5. K.C. Louden, Compiler Construction: Principles and Practice, Cengage Learning, 1997.
6. D. Brown, J. Levine, and T. Mason, LEX and YACC, O□Reilly Media, 1992.

BTCS-914 Big Data (Elective-III)

BigData Overview

Analysis of data at Rest- Hadoop analytics: Limitations of existing distributing systems, Hadoop Approach, Hadoop Architecture, Distributed file system: HDFS and GPFS, Internals of Hadoop MR engine, Need for High level language- JAQL and PIG

Introduction to Text Analytics: Using Regular expressions, Using AQL, Sentiment analysis

No SQL: JSON store, MongoDB, RDF, HBASE

Analytics: Clustering, Classification, Segmentation, Linear regression, ML

Search: Indexing and Indexing Techniques, Create inverted index using JAQL, Lab using Data Explorer

Bundling Hadoop job: Application, Use BI tooling to create application, Publish applications.

Analysis of data in motion – Real time analytics

Introduction to streams computing, Challenges/limitations of conventional Systems, Solving a real time analytics problem using conventional system, Challenges to be solved - scalability, thread pooling, etc., Understanding the challenges in handling streaming data from the real world and how to address those using stream computing**,** Benefits of stream computing in Big Data world**,** Realtime Analytics Platform(RTAP).

Suggested Readings/Books

1. Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, by Chris Eaton, Paul Zikopoulos
2. Big Data Analytics: Turning Big Data into Big Money By Frank J. Ohlhorst
3. Ethics of Big Data By Kord Davis
4. Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends, By Michael Minelli, Michele Chambers, Ambiga Dhiraj

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BTCS 915 Digital Image Processing (Elective-III)

Introduction to Image Processing: Digital Image representation, Sampling & Quantization, Steps in image Processing, Image acquisition, color image representation (8)

Image Transformation & Filtering: Intensity transform functions, histogram processing, Spatial filtering, Fourier transforms and its properties, frequency domain filters, color models, Pseudo coloring, color transforms, Basics of Wavelet Transforms (12)

Image Restoration: Image degradation and restoration process, Noise Models, Noise Filters, degradation function, Inverse Filtering, Homomorphic Filtering (5)

Image Compression: Coding redundancy, Interpixel redundancy, Psychovisual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression. (8)

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors, Regional (12)

Suggested Readings/Books

1. Gonzalez and Woods: Digital Image Processing ISDN 0-201-600- 781, Addison Wesley 1992.
2. Boyle and Thomas: Computer Vision - A First Gurse 2nd Edition, ISBN 0-632-028-67X, Blackwell Science 1995.
3. Pakhera Malay K: Digital Image Processing and Pattern Recogination, PHI.
4. Trucco & Verri: Introductory Techniques for 3-D Computer Vision, Prentice Hall, Latest Edition
5. Low: Introductory Computer Vision and Image Processing, McGraw-Hill 1991, ISBN 0-07-707403-3.
6. Jain, Kasturi and Schunk: Machine Vision, McGraw-HiII. 1995 ISBN 0070320187.

7. Sonka, Hlavac, Boyle: Digital Image –Processing and Computer Vision First ed. ISBN 978813150557, Cengage Learning,2011

BTCS 916 Enterprise Resource Planning (Elective-III)

ERP AND TECHNOLOGY : Introduction – Related Technologies – Business Intelligence – E-Commerce and EBusiness – Business Process Reengineering – Data Warehousing – Data Mining – OLAP – Product life Cycle management – SCM – CRM (10)

ERP IMPLEMENTATION: Implementation Challenges – Strategies – Life Cycle – Pre-implementation Tasks – Requirements Definition – Methodologies – Package selection – Project Teams –Process Definitions – Vendors and Consultants – Data Migration – Project management – Post Implementation Activities. (10)

ERP IN ACTION & BUSINESS MODULES: Operation and Maintenance – Performance – Maximizing the ERP System – Business Modules – Finance – Manufacturing – Human Resources – Plant maintenance – Materials Management – Quality management – Marketing – Sales, Distribution and service. (8)

ERP MARKET: Marketplace – Dynamics – SAP AG – Oracle – PeopleSoft – JD Edwards – QAD Inc – SSA Global – Lawson Software – Epicor – Intutive. (9)

ERP Application: Enterprise Application Integration – ERP and E-Business – ERP II – Total quality management – Future Directions – Trends in ERP. (6)

Suggested Readings/Books

1. Alexis Leon, “ERP DEMYSTIFIED”, Tata McGraw Hill, Second Edition, 2008.
2. Mary Sumner, “Enterprise Resource Planning”, Pearson Education, 2007.
3. Jim Mazzullo,”SAP R/3 for Everyone”, Pearson,2007.
4. Jose Antonio Fernandz, “ The SAP R /3 Handbook”, Tata McGraw Hill, 1998.
5. Biao Fu, “SAP BW: A Step-by-Step Guide”, First Edition, Pearson Education, 2003.

PUNJAB TECHNICAL UNIVERSITY KAPURTHALA

Scheme& Syllabus of B. Tech. Mechanical Engineering [M.E.]

for Batch 2011

By

Board of Studies Mechanical Engineering/ Production Engineering / Industrial Engineering

Third Semester

Contact Hours: 34 Hrs.

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTME301	Strength of Materials- I	3	1	-	40	60	100	4
BTME302	Theory of Machines-I	3	1	-	40	60	100	4
BTME303	Machine Drawing	1	-	6	40	60	100	4
BTME304	Applied Thermodynamics -I	4	1	-	40	60	100	5
BTME305	Manufacturing Processes – I	4	-	-	40	60	100	4
BTME306	Engineering Materials & Metallurgy	3	-	-	40	60	100	3
BTME307	Engineering Materials & Metallurgy Lab	-	-	2	30	20	50	1
BTME308	Strength of Materials Lab.	-	-	2	30	20	50	1
BTME309	Applied Thermodynamics Lab	-	-	2	30	20	50	2
Advisory Meeting		-	-	1	-	-	-	-
BTME 310	Workshop Training*	-	-	-	60	40	100	1
	Total	**18**	**3**	**13**	**390**	**460**	**850**	**29**

*** Workshop Training will be imparted in the Institution at the end of 2nd semester for Four (04) weeks duration (Minimum 36 hours per week). Industrial tour will also form part of this training.**

Fourth Semester

Contact Hours: 32 Hrs.

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTME401	Strength of Materials – II	4	1	-	40	60	**100**	5
BTME402	Theory of Machines – II	4	1	-	40	60	**100**	5
BTME403	Fluid Mechanics	4	1	-	40	60	**100**	5
BTME404	Applied Thermodynamics - II	4	2	-	40	60	**100**	5
BTME405	Manufacturing Processes-II	4	-	-	40	60	**100**	4
BTME406	Fluid Mechanics Lab	-	-	2	30	20	**50**	1
BTME407	Manufacturing Processes Lab	-	-	2	30	20	**50**	1
BTME408	Theory of Machines Lab	-	-	2	30	20	**50**	1
Advisory Meeting		-	-	1	-	-	-	-
General Fitness		-	-	-	100	-	**100**	-
	Total	**20**	**05**	**07**	**390**	**360**	**750**	27

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Annex. I

B.Tech. (Mechanical)

5th Semester B.Tech (Mechanical)								
Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Credits
					Internal	External		
BTAM-500	Mathematics-III	3	1	-	40	60	**100**	4
BTME-501	Design of Machine Elements – I	4	2	-	40	60	**100**	6
BTME-502	Computer aided Design and Manufacturing	4	-	-	40	60	**100**	4
BTME-503	Mechanical Measurement and Metrology	4	-	-	40	60	**100**	4
BTME-504	Industrial Automation and Robotics	4	-	-	40	60	**100**	4
BTME-505	Automobile Engineering	4	-	-	40	60	**100**	4
BTME-506	Computer aided Design and Manufacturing Lab	-	-	2	30	20	**50**	1
BTME-507	Mechanical Measurement and Metrology Lab.	-	-	2	30	20	**50**	1
BTME-508	Industrial Automation and Robotics Lab			1*	15	10	**25**	0.5
BTME-509	Automobile Engineering Lab			1*	15	10	**25**	0.5
	Advisory meeting	-	-	1	-	-	-	
IT 500	**Industrial Training	-	-	-	60	40	**100**	
	Total	**23**	**3**	**7**	**390**	**460**	**850**	29

Total Contact Hours = 33

***The students will attend these labs for two hours on every alternative turn.**

****The marks of Industrial/Institutional Training imparted at the end of 4th Semester will be included here.**

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B.Tech. (Mechanical)

6th Semester B.Tech (Mechanical)								
Code	Title of the course	L	T	P	Maximum Marks		Total Marks	Credits
					Internal	External		
BTME-601	Design of Machine Elements –II	4	2	0	40	60	**100**	6
BTME-602	Heat Transfer	4	1	-	40	60	**100**	5
BTME-603	Fluid Machinery	3	1	-	40	60	**100**	4
BTME-604	Statistical and Numerical Methods in Engineering	3	1		40	60	**100**	4
BTME- DE	Departmental Elective-I	4	-	-	40	60	**100**	4
BTME-605	Heat Transfer Lab.	-	-	2	30	20	**50**	1
BTME 606	Fluid Machinery lab	-	-	2	30	20	**50**	1
BTME-607	Minor Project*	-	-	2	30	20	**50**	1
	Advisory meeting	-	-	1	-	-	-	
GF-600	General Fitness	-	-	-	100	-	**100**	
	Total	**18**	**5**	7	390	360	**750**	26

Total Contact Hours = 30

***The project work will be carried out in parts as minor project in 6th semester and major project in 7/8th semester. The literature survey, problem formulation, assessment for viability of the project, objectives and methodology for the project shall be decided in 6th semester. The same project problem is to be extended in the major project in 7th/8th semester. The minor project may be carried out by a group of students (2 to 4)**

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B.Tech. (Mechanical)

7th /8th Semester B.Tech (Mechanical) * Industrial Training (One Semester)					
Code	**Title of the course**	**Maximum Marks**		**Total Marks**	**Credits**
		Internal	**External**		
BTME-IT	**Software Training**	150	100	**250**	**8**
	Industrial oriented Project Training	300	200	**500**	**10**
		450	300	**750**	**18**
Total Contact Hours per Week = 36 (minimum)					
*** Industrial Training in reputed industries will be arranged for complete one semester.**					

7th /8th Semester B.Tech (Mechanical)								
Code	**Title of the course**	**L**	**T**	**P**	**Maximum Marks**		**Total Marks**	**Credits**
					Internal	**External**		
BTME-801	Industrial Engineering and Management	4	-	-	40	60	**100**	4
BTME-802	Refrigeration & Air Conditioning	4	1	-	40	60	**100**	5
BTME-803	Mechanical Vibrations	4	1		40	60	**100**	5
BTME-DE/	Department Elective-II	4	-	-	40	60	**100**	4
	Open Elective	4			40	60	**100**	4
BTME-804	Refrigeration & Air Conditioning Lab	-	-	2	30	20	**50**	1
BTME-805	Mechanical Vibration lab	-	-	2	30	20	**50**	1
BTME-806	Major Project*	-	-	6	100	50	**150**	3
	Advisory meeting	-	-	1	-	-	-	-
GF 800	General Fitness	-	-	-	100	-	**100**	-
	Total	**20**	**2**	**11**	**460**	**390**	**850**	27

Total Contact Hours = 33

*** The problem of the minor project "formulated" during 6th Semester is to extended and executed in major project by the same group of students. The design/construction/fabrication/computer modeling/experimentation etc. is to be carried out. The results and analysis followed by discussion regarding suitability /non suitability of the project or any positive gain in the project made with conclusions and recommendations for future extension of the project must be covered.**

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Department Electives

Group-1

DE/ME-1.1 I.C Engines
DE/ME-1.2 Cryogenic Technology
DE/ME-1.3 Non Conventional Energy resources
DE/ME-1.4 Energy Conservation and Management
DE/ME-1.5 Fluid Mechanics-II
DE/ME-1.6 Solar Energy
DE/ME-1.7 Heat Exchanger Design
DE/ME-1.8 Power Plant Engg.
DE/ME-1.9 Gas Dynamics

Group-2
DE/PE-2.0 Non-Traditional Machining
DE/PE-2.1 Industrial Engg
DE/ME-2.2 Modeling and Simulation
DE/ME-2.3 Operations Management
DE/ME-2.4 Non -Destructive Testing
DE/ME-2.5 Total Quality Management
DE/ME-2.6 Maintenance and Reliability Engg
DE/ME-2.7 Material Management
DE/ME-2.8 Management Information System
DE/ME-2.9 Entrepreneurship

Group-3
DE/PE-3.0 Product Design and Development
DE/PE-3.1 Machine Tool Design
DE/PE-3.2 Optimization Techniques
DE/ME-3.3 Tool Design
DE/ME-3.4 Finite Element Method
DE/ME-3.5 Experimental Stress Analysis
DE/ME-3.6 Industrial Tribology
DE/ME-3.7 Theory of plasticity
DE/ME-3.8 Mechatronics

Note:

1. A Department Elective subject may normally be offered only if at least 10 students of the class have opted for it

2. The student shall select both the electives courses from the same group out of three groups (Group-1, Group-2, and Group –3)

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Third Semester

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BTME 301 Strength of Materials – I

Course Objective/s and Expected Outcome/s: The course is designed to understand the basic concepts of stress, strain and their variations due to different type of loading. The concept of Mechanical properties, Poisson's ratio, bulk modulus, elastic modulus, modulus of rigidity, combined stress and strain, principal stress, principal plane, bending moment and shear force in beam under various loading conditions, Understanding of torsional shear stress in solid and hollow shaft; principal and maximum shear stress in a circular shaft subjected to combined stresses, stresses in struts and columns subjected to axial load; bending stress, slope and deflection under different loading and supporting conditions. After the study of this course, a student is expected to analyze different stresses, strains and deflection for designing a simple mechanical element under various loading conditions.

Unit –I

Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress ellipse of stress and their applications. Generalized Hook's law, principal stresses related to principal strains.

Unit –II

Bending Moment (B.M) and Shear Force (S.F) Diagrams: S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under the following loads:

a) Concentrated loads
b) Uniformity distributed loads over the whole span or part of span
c) Combination of concentrated and uniformly distributed load
d) Uniformly varying loads
e) Application of moments

Unit –III

Bending Stresses In Beams: Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams.

Unit –IV

Torsion: Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion.

Unit –V

Columns and struts: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.

Unit –VI

Slope and deflection: Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for the following:

- **a)** Cantilevers
- **b)** Simply supported beams with or without overhang
- **c)** Under concentrated loads, uniformly distributed loads or combination of concentrated & uniformly distributed loads.

Suggested Readings / Books:

- D.S. Bedi, ***Strength of Materials,*** Khanna Book Publishing Company.
- E.P. Popov, ***Mechanics of Materials-(SI Version),*** Prentice Hall India.
- R.S Lehri and A.S. Lehri***, Strength of Materials,*** Kataria and Sons.
- S.S.Rattan, ***Strength of Materials,*** Tata McGraw Hill.
- Timoshenko and Young, ***Elements of Strength of Materials,*** East West Press (EWP).
- James M Gere and Barry J. Goodno, ***Strength of Materials,*** Cengage Learning.

BTME-302 Theory of Machines-I

Course Objective/s & Expected Outcome/s: The course under Theory of Machine-I has been designed to cover the basic concepts of kinematic aspects of mechanical machines and major parts used in running of the machines. The students will understand the basic concepts of machines and able to understand constructional and working features of important machine elements. The students should be able to understand various parts involved in kinematics of machines for different applications. The students shall also be able to understand requirements of basic machine parts which would help them to understand the design aspects of the machine parts

Unit –I

Basic Concept of machines: Link, Mechanism, Kinematic Pair and Kinematic Chain, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain and Double Slider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity, and Acceleration of mechanisms (including Corliolis Components).

Unit –II

Lower and higher Pairs: Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs With Examples

Unit –III

Belts, Ropes and Chains: Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission.

Unit –IV

Cams: Types of cams and follower, definitions of terms connected with cams. Displacement, velocity and acceleration diagrams for cam followers. Analytical and Graphical design of cam profiles with various motions (SHM, uniform velocity, uniform acceleration and retardation, cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles.

Unit –V

Friction Devices: Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tyres of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission).

Unit –VI

Flywheels: Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines.

Unit –VII

Governors: Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction.

Suggested Readings / Books:

- S. S. Rattan, Theory of Machines, Tata McGraw Hill, New Delhi.
- Jagdish Lal, Theory of Mechanisms & Machines, Metropolitan Book Co.
- Thomas Beven, Theory of Machines, Longman's Green & Co., London.
- W. G. Green, Theory of Machines, Blackie & Sons, London
- V.P. Singh, Theory of Machines Dhanpat Rai.

BTME-303 Machine Drawing

Course Objective/s and Expected Outcome/s: The objective of this course is to make students understand the principles and requirements of production drawings and learning how to assemble and disassemble important parts used in major mechanical engineering applications. After going through this course, the student shall be able to understand the drawings of mechanical components and their assemblies along with their utility for design of components

Unit –I

Introduction: Principles of Drawing, Requirements of production drawing, Sectioning and conventional representation, Dimensioning, symbols of standard tolerances, Machining Symbols, introduction and Familiarization of Code IS: 296

Unit –II

Fasteners: Various types of screw threads, types of nuts and bolts, screwed fasteners, welding joints and riveted joints

Unit –III

Assembly and Disassembly:

a) **Couplings:** Solid or Rigid Coupling, Protected Type Flange coupling, Pin type flexible coupling, muff coupling, Oldham, universal coupling, claw coupling, cone friction clutch, free hand sketch of single plate friction clutch.

b) Knuckle and cotter joints

c) **Pipe and Pipe Fittings:** flanged joints, spigot an socket joint, union joint, hydraulic an expansion joint

d) **IC Engine Parts:** Piston, connecting rod

e) **Boiler Mountings:** Steam stop valve, feed check valve, safety valve, blow off cock.

f) **Bearings:** Swivel bearing, thrust bearing, Plummer block, angular plumber block

g) **Miscellaneous:** Screw Jack, Drill Press Vice, Crane hook, Tool Post, Tail Stock, Drilling Jig.

NOTE:

I. *Drawing Practice is to be done as per code IS: 296.*

II. *First angle projection to be used. Drawings should contain bill of materials and should illustrate finish.*

III. *The syllabus given above indicates the broad outlines and the scope of the subject to be covered. It is not necessary to cover all the drawing exercises of the types of machine tools mentioned above.*

IV. *The University paper shall be having following structure / weighage:*

Section A *– Short type questions based upon whole syllabus- 30%*

Section B*- Free Hand sketching of machine parts etc.-20%*

Section C*- Assembly drawing of machine parts with at least two views -50%*

Suggested Readings / Books:

- Ajit Singh, Machine Drawing (including Auto CAD), Tata McGraw Hill.
- A Text Book of Machine Drawing by R. K. Dhawan, S. Chand and Co. Ltd.
- N.D. Bhatt, Machine Drawing, Charotar publications.
- N. Sidheshwar, Machine Drawing, Tata McGraw Hill.
- P.S. Gill, Machine Drawing, BD Kataria and Sons.
- V Lakshmi Narayanan and Mathur, Text-book of Machine Drawing.

BTME 304 Applied Thermodynamics-I

Course Objective/s and Expected Outcome/s: This course is designed for comprehensive study of combustion and thermal aspects in internal combustion engines, steam power plants and its allied components. This will enable the students to understand combustion phenomenon and thermal analysis of steam power plant components. The students will be able to identify, track and solve various combustion problems and evaluate theoretically the performance of various components involved in steam power plants and internal combustion engines.

Unit –I

Combustion: Combustion Equations **(**Stoichiometric and non- Stoichiometric**).** Combustion problems in Boilers and IC engines/Calculations of air fuel ratio, Analysis of products of combustion, Conversion of volumetric analysis into gravimetric analysis and vice-versa, Actual weight of air supplied, Use of mols, for solution of combustion problems, Heat of formation, Enthalpy of formation, Enthalpy of reaction, Adiabatic flame temperature.

Unit –II

IC Engines Introduction: Actual Engine Indicator diagrams and valve-timing diagrams for two stroke and four stroke S.I. and C.I. Engines; **Construction and Working Principle** of Wankel rotary engine; Principle of simple carburator, Injection systems in Diesel and Petrol Engines(Direct Injection, MPFI in SI and CI Engines, respectively). Essential requirements for Petrol and Diesel Fuels. Theory of combustion in SI and CI Engines; Various stages of combustion; Pressure-time/crank - Angle diagrams; Various phenomenon such as turbulence, squish and swirl, dissociation, pre-ignition/auto- ignition, and after burning etc.; Theory of knocking (ie,. detonation) in SI and CI Engines; Effect of engine variables on the Delay Period in SI and CI engines; Effect of various parameters on knock in SI and CI Engines; Methods employed to reduce knock in SI and CI Engines; Octane and Cetane rating of fuels; Knockmeter; Dopes and inhibitors; Performance curves/maps of SI and CI Engines; Effect of knocking on engine performance; Effect of ***compression ratio*** and ***air-fuel ratio*** on power and efficiency of engine; Variation of engine power with altitude; Supercharging and turbo charging of SI and CI Engines; Advantages and applications of supercharging; Emissions from SI and CI Engines and methods to reduce/control them. Logarithmic plotting of PV-diagrams. High speed Engine Indicators.

Unit –III

Properties of Steam

Pure substance; Steam and its formation at constant pressure: wet, dry, saturated and super-heated steam; Sensible heat(enthalpy), latent heat and total heat (enthalpy) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and internal energy of steam; Use of Steam Tables and Mollier Chart; Basic thermodynamic processes with steam (isochoric, isobaric, isothermal, isentropic and adiabatic process) and their representation on **T-S** Chart and Mollier Charts(h-s diagrams). Significance of Mollier Charts.

Unit –IV

Steam Generators - Definition: Classification and Applications of Steam Generators; Working and constructional details of fire-tube and water-tube boilers: (Cochran, Lancashire, Babcock and Wilcox boilers); Merits and demerits of fire-tube and water-tube boilers; Modern high pressure boilers (Benson boiler, La Mont boiler) and Super critical boilers (**Once through boilers-*Tower type***); Advantages of forced circulation; Description of boiler mountings and accessories: Different types of Safety Valves, Water level indicator, pressure gauge, Fusible plug, Feed pump, Feed Check Valve, Blow-off Cock, Steam Stop-Valve, Economiser, Super-heater; Air pre-heater and Steam accumulators; Boiler performance: equivalent evaporation, boiler efficiency, boiler trial and heat balance; Types of draught and Calculation of chimney height.

Unit –V

Vapour Power Cycle Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding (feed-water-heating), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles.

Unit –VI

Steam Nozzles - Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Area of **throat** and at **exit** for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and convergent-divergent nozzles; Calculation of Nozzle dimensions (length and diameters of throat and exit); Supersaturated (or metastable) flow through nozzle.

Unit –VII

Steam Turbines Introduction; Classification; Impulse versus Reaction turbines. **Simple impulse turbine**: pressure and velocity variation, Velocity diagrams/triangles; Combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge;

Unit –VIII

De Laval Turbine: Compounding of impulse turbines: purpose, types and pressure and velocity variation, velocity diagrams/triangles, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency;

Unit –IX

Impulse-Reaction Turbine: pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangle and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height; **Multistaging**: Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction turbines; Co-generation; Economic assessment; Governing of steam turbines.

Unit –X

Steam Condensers Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity; **Cooling towers:** function, types and their operation.

Suggested Readings / Books:

- R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
- J.S. Rajadurai, Thermodynamics and Thermal Engineering, New Age International (P) Ltd. Publishers.
- D.S. Kumar and V.P. Vasandani, Heat Engineering, Metropolitan Book Co. Pvt. Ltd.
- K. Soman, Thermal Engineering, PHI Learning Pvt. Ltd.
- G. Rogers and Y. Mayhew, Engineering Thermodynamics, Pearson.
- W.A.J. Keartan, Steam Turbine: Theory and Practice, ELBS Series.
- Heywood, Fundamentals of IC Engines, McGraw Hill.
- V. Ganeshan, Internal Combustion Engines, Tata McGRaw Hill.

BTME 305 Manufacturing Processes –I

Course Objective/s and Outcome/s: This course is designed to provide students with an overview of a wide variety of manufacturing processes for processing of engineering materials. The students will learn principles, operations and capabilities of various metal casting and metal joining processes. They will also learn about the defects, their causes and remedies in these processes. Upon completion of the course, the students should have the ability to understand the importance of the manufacturing processes and to select a suitable metal casting and metal joining processes to fabricate an engineering product.

Unit –I

Introduction: Classification of manufacturing processes, selection criteria for manufacturing processes, general trends in manufacturing.

Unit –II

Casting Processes: Introduction to metal casting. patterns: types, materials and allowances. Moulding materials: moulding sand compositions and properties, sand testing, types of moulds, moulding machines. Cores: function, types, core making process, core-prints, chaplets. Elements of gating system and risers and their design. Design considerations of castings. Melting furnaces, cupola furnace, charge calculations, induction furnaces. Casting processes: sand casting, shell mould casting, investment casting, permanent mould casting, full mould casting, vacuum casting, die casting, centrifugal casting, and continuous casting. Metallurgical considerations in casting, Solidification of metals and alloys, directional solidification, segregation, nucleation and grain growth, critical size of nucleus. Cleaning and finishing of castings.

Unit –III

Welding Processes: Introduction and classification of welding processes, to welding processes, weldability, welding terminology, general principles, welding positions, and filler metals. Gas welding: principle and practice, oxy-acetylene welding equipment, oxy-hydrogen welding. Flame cutting. Electric arc welding: principle, equipment, relative merits of AC & DC arc welding. Welding processes: manual metal arc welding, MIG welding, TIG welding, plasma arc welding, submerged arc welding. Welding arc and its characteristics, arc stability, and arc blow. Thermal effects on weldment: heat affected zone, grain size and its control. Electrodes: types, selection, electrode coating ingredients and their function. Resistance welding: principle and their types i.e. spot, seam, projection, up-set and flash. Spot welding machine. Advanced welding processes: friction welding, friction stir welding, ultrasonic welding, laser beam welding, plasma arc welding, electron beam welding, atomic hydrogen welding, explosive welding, thermit welding, and electro slag welding. Considerations in weld joint design. Other joining processes: soldering, brazing, braze welding.

Unit –IV

Inspection and Testing: Casting defects, their causes and remedies. Welding defects, their causes and remedies. Destructive and non destructive testing: visual inspection, x-ray radiography, magnetic particle inspection, dye penetrate test, ultrasonic inspection, eddy current testing, hardness testing, and micro hardness testing.

Suggested Readings / Books:

- A. Manna, A Textbook of Manufacturing Science and Technology, PHI Publishers.
- H.S. Shan, Manufacturing Processes, Vol.I. , Pearson Publishers.
- P. N. Rao, Manufacturing Technology, Foundry, Forming & Welding, Tata McGraw Hill.
- R.S. Parmar ,Welding Engineering & Technology, Khanna Publishers.
- Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.

BTME-306 Engineering Materials & Metallurgy

Course Objective/s and Outcome/s: This course is designed to develop fundamental concepts of crystallography, phase transformation and heat treatment processes. The students will learn the atomic structure of metals, imperfections, diffusion mechanisms and theories of plastic deformation. They will also understand equilibrium diagrams, time-temperature transformation curves and heat treatment processes. Upon completion of the course, the students will be able to understand the concepts of crystal structure, microstructure and deformation. They will also be able to understand the phase diagrams which are useful for design and control of heat treating processes.

Unit –I

Crystallography: Atomic structure of metals, atomic bonding in solids, crystal structures, crystal lattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and non crystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Diffusion: diffusion mechanisms, steady-state and non-steady-state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery, re-crystallization.

Unit –II

Phase Transformation: General principles of phase transformation in alloys, phase rule and equilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagram and various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications.

Unit –III

Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening. Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability.

Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced by alloying elements. Composition of alloy steels.

Unit –IV

Ferrous Metals and Their Alloys: Introduction, classification, composition of alloys, effect of alloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel.

Suggested Readings / Books:

- B. Zakharov, Heat Treatment of Metals, University Press.
- T. Goel and R.S. Walia, Engineering Materials & Metallurgy.
- Sidney H Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hill.
- V. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning.
- Y. Lakhin , Engineering Physical Metallurgy, Mir Publishers.

BTME-307 Engineering Materials & Metallurgy Lab

1. Preparation of models/charts related to atomic/crystal structure of metals.
2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4. Practice of specimen preparation (cutting, mounting, polishing ,etching) of mild steel, aluminium and hardened steel specimens.
5. Study of the microstructure of prepared specimens of mild steel, Aluminium and hardened steel.
6. Identification of ferrite and pearlite constituents in given specimen of mild steel.
7. Determination of hardenabilty of steel by Jominy End Quench Test.

BTME-308 Strength of Materials Lab

1. To perform tensile test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.
2. To perform compression test on Cast Iron.
3. To perform any one hardness tests (Rockwell, Brinell & Vicker's test).
4. To perform impact test to determine impact strength.
5. To perform torsion test and to determine various mechanical properties.
6. To perform Fatigue test on circular test piece.
7. To perform bending test on beam and to determine the Young's modulus and modulus of rupture.
8. Determination of Bucking loads of long columns with different end conditions.

9. To evaluate the stiffness and modulus of rigidity of helical coil spring.

BTME 309 Applied Thermodynamics Lab.

1. Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.

2. To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.

3. Study of working, construction, mountings and accessories of various types of boilers.

4. To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.

5. Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.

6. Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).

7. Performance testing of a diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the smoke density. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.

8. Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.

9. Study of construction and operation of various types of steam condensers and cooling towers.

Fourth Semester

BTME 401 Strength of Materials-II

Course Objective/s and Outcome/s: The course is designed to understand the concepts of strain energy, resilience, stress under impact loading; shear stress distribution in a beam of various cross sections; stress in curved cross sections; stresses in helical, spiral and leaf springs; stress and strain analysis of thin, thick cylinder and spheres subjected to internal pressure; and various failure theories. The outcome of the course is to enhance deep and vigorous understanding of stress analysis in various machine elements, so that a student can properly analyze and design a mechanical member from the strength point of view under various conditions.

Unit –I

Strain energy: Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection.

Unit –II

Theories of failure: Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two dimensional stress systems.

Unit –III

Springs: Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring-deflection and bending stresses

Unit –IV

Thin cylinders and spheres: Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume.

Unit –V

Thick cylinders: Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress.

Unit –VI

Bending of curved beams: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides.

Unit –VII

Shear stresses in beams: Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance.

Unit –VIII

Rotational discs: Stresses in rotating discs and rims of uniform thickness; disc of uniform strength.

Suggested Readings / Books:

- D.S. Bedi, Strength of materials, Khanna book publishing company.
- G.H. Ryder, Strength of materials, Macmillan India Ltd.
- R.S Lehri and A.S. Lehri, Strength of materials, vol. 2, S. K. Kataria and Sons.
- S.S.Rattan, Strength of materials, Tata McGraw Hills.
- Timoshenko and Gere, Mechanics of materials, CBS publishers.

BTME 402 Theory of Machines – II

Course Objective/s & Outcome/s: The students will understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine. Students should be able to understand balancing of masses and design of gears & gear trains. They will also gain knowledge of kinematic synthesis and different applications of gyroscopic effect.

Unit –I

Static force analysis:, Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces

Unit –II

Dynamic force analysis Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four bar linkage.

Unit –III

Balancing: Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses, and condition of balance in multi cylinder in line V-engines , concept of direct and reverse crank, balancing of machines, rotors, reversible rotors.

Unit –IV

Gears: Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for involute rack, helical, spiral, bevel and worm gears. Center distance for spiral gears and efficiency of spiral gears

Unit –V

Gear Trains: Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel.

Unit –VI

Gyroscopic motion and couples: Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehicles and stone crusher.

Unit –VII

Kinematic synthesis of Mechanism: Freudenstien equation, Function generation errors in synthesis, two and three point synthesis, Transmission angles, least square techniques.

Suggested Readings / Books:

- S.S. Rattan, Theory of Machines, Tata Mc. Graw Hill.
- John, Gordon, and Joseph, Theory of Machines and Mechanisms, Oxford University Press.
- Hams Crone and Roggers, Theory of Machines.
- Shigley, Theory of Machines, Mc Graw Hill.
- V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.

BTME 403 Fluid Mechanics

Course Objective/s and Expected Outcome/s: This course is designed for the undergraduate mechanical engineering students to develop an understanding of the behavior of fluids at rest or in motion and the subsequent effects of the fluids on the boundaries as the mechanical engineers has to deal with fluids in various applications. This course will also develop analytical abilities related to fluid flow. It is expected that students will be able to have conceptual understanding of fluids and their properties, apply the analytical tools to solve different types of problems related to fluid flow in pipes, design the experiments effectively and do the prototype studies of different types of machines and phenomenon.

Unit –I

Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids.

Unit –II

Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subjected to : (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation.

Unit –III

Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net.

Unit –IV

Fluid Dynamics: Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation (using principle of conservation of energy and equation of motion) and its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines); Impulse momentum equation;

Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions.

Unit –V

Dimensional Analysis and Similitude: Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froudes, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws.

Unit –VI

Internal Flows: Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart.

Unit –VII

Pressure and Flow Measurement: Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters.

Suggested Readings / Books:

- D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, S.K. Kataria and Sons Publishers.
- S.K. Som, G. Biswas and S. Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw Hill.
- C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, Fluid Mechanics and Machinery, Oxford University Press.
- Y.A. Cengel and J.M. Cimbala, Fluid Mechanics - Fundamentals and Applications, Tata McGraw Hill.
- B.R. Munson, D.F. Young, T.H. Okiishi and W.W. Huebsch, Fundamentals of Fluid Mechanics, John Wiley and Sons.
- J.F. Douglas and J.M. Gasiorek, J.A. Swaffield and L.B. Jack, Fluid Mechanics, Pearson.
- V.L. Streeter, E.B. Wylie and K.W. Bedford, Fluid Mechanics, Tata McGraw Hill.

BTME 404 Applied Thermodynamics-II

Course Objectives and Expected Outcomes: This course is designed for providing comprehensive understanding and thermodynamic analysis of positive displacement air compressors and thermal turbo machines used in power generation, aircraft, spacecraft and rocket propulsion. The students will be able to understand the thermodynamic working as well as performance of thermal turbo power machinery. They will also be able to select various thermal devices required for aforesaid applications.

Unit –I

Air Compressors- Introduction: Classification of Air Compressors; Application of compressors and use of compressed air in industry and other places; Complete representation of compression process on P-v and T-s coordinates with detailed description of areas representing total work done and polytropic work done; Areas representing ***energy lost*** in internal friction, *energy carried away by cooling water* and ***additional flow work*** being done for un-cooled and cooled compression on T-S coordinates; Best value of index of compression; Isentropic, polytropic and isothermal efficiencies and their representation in terms of ratio of areas representing various energy transfers on T-s coordinates.

Unit –II

Reciprocating Air Compressors

Single stage single acting reciprocating compressor (with and without clearance volume): construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic, mechanical efficiency, **Clearance Volumetric efficiency**, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; Multistage compressors: purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; ***isothermal***, ***overall thermal***, ***isentropic***, ***polytropic*** and ***mechanical*** efficiencies; Performance curves.

Unit –III

Positive Displacement Rotary Compressors Introduction: Comparison of rotary positive displacement compressors with reciprocating compressors; Classification of rotary compressors; Construction, operation, work input and efficiency of positive displacement type of rotary compressors like Roots blower, Lysholm compressor and Vane type Blower.

Unit –IV

Thermodynamics of Dynamic Rotary Compressors: Applications of Steady Flow Energy Equation and thermodynamics of dynamic(i.e., *centrifugal* and *axial flow m/cs*) compressors; Stagnation and static values of pressure, Temperature and enthalpy etc. for flow through dynamic rotary machines; Complete representation of compression process on T-S coordinates with detailed description of areas representing total work done, polytropic work done; ideal work required for compression process, areas representing energy lost in internal friction, energy carried away by cooling water on TS coordinates for an uncooled and cooled compression; ***isentropic***, ***polytropic***, and ***isothermal efficiencies*** as ratios of the areas representing various energy transfers on T-S coordinates.

Unit –V

Centrifugal Compressors:- Complete thermodynamic analysis of centrifugal compressor stage; Polytropic, isentropic and isothermal efficiencies; Complete representation of compression process in the centrifugal compressor starting from ambient air flow through the suction pipe, Impeller, Diffuser and finally to delivery pipe on T-S coordinates; Pre-guide vanes and pre-whirl; Slip factor; Power input factor; Various modes of energy transfer in the impeller and diffuser; Degree of Reaction and its derivation; Energy transfer in backward, forward and radial vanes; Pressure coefficient as a function of slip factor; Efficiency and out-coming velocity profile from the impeller; Derivation of non-dimensional parameters for plotting compressor characteristics; Centrifugal compressor characteristic curves; Surging and choking in centrifugal compressors.

Unit –VI

Axial Flow Compressors

Different components of axial flow compressor and their arrangement; Discussion on flow passages and simple theory of aerofoil blading; Angle of attack; coefficients of lift and drag; Turbine versus compressor blades; Velocity vector; Vector diagrams; Thermodynamic analysis; Work done on the compressor and power calculations; Modes of energy transfer in rotor and stator blade flow passages; Detailed discussion on work done factor, degree of reaction, blade efficiency and their derivations; ***Isentropic***, ***polytropic*** and ***isothermal efficiencies***; Surging, Choking and Stalling in axial flow compressors; Characteristic curves for axial flow compressor; flow parameters of axial flow compressor like Pressure Coefficient, Flow Coefficient, Work Coefficient, Temperature-rise Coefficient and Specific Speed; Comparison of axial flow compressor with centrifugal compressor and reaction turbine; Field of application of axial flow compressors.

Unit –VII

Gas Turbines Classification and comparison of the Open and Closed cycles; Classification on the basis of combustion (at ***constant volume*** or ***constant pressure***); Comparison of gas turbine with a steam turbine and IC engine; Fields of application of gas turbines; Position of gas turbine in power industry; Thermodynamics of constant pressure gas turbine cycle (Brayton cycle); Calculation of net output, work ratio and thermal efficiency of ideal and actual cycles; Cycle air rate, temperature ratio;

Effect of changes in specific heat and that of mass of fuel on power and efficiency; Operating variables and their effects on thermal efficiency and work ratio; Thermal refinements like regeneration, inter-cooling and re-heating and their different combinations in the gas turbine cycle and their effects on gas turbine cycle i.e. gas turbine cycle. Multistage compression and expansion; Dual Turbine system; Series and parallel arrangements; Closed and Semi-closed gas turbine cycle; Requirements of a gas turbine combustion chamber; Blade materials and selection criteria for these materials and requirements of blade materials; Gas turbine fuels.

Unit –VIII

Jet Propulsion Principle of jet propulsion; Description of different types of jet propulsion systems like rockets and thermal jet engines, like **(i) Athodyds**(ramjet and pulsejet), **(ii)** Turbojet engine, and (**iii)** Turboprop engine. Thermodynamics of turbojet engine components; Development of thrust and methods for its boosting/augmentation; Thrust work and thrust power; Propulsion energy, Propulsion and thermal (internal) efficiencies; Overall thermal efficiency; Specific fuel c onsumption**;** Rocket propulsion, its thrust and thrust power; Propulsion and overall thermal efficiency; Types of rocket motors (e.g. solid propellant and liquid propellant systems); Various common propellant combinations (i.e. fuels) used in rocket motors; Cooling of rockets; Advantages and disadvantages of jet propulsion over other propulsion systems; Brief introduction to performance characteristics of different propulsion systems; Fields of application of various propulsion units.

Suggested Readings / Books:

- R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.
- J.S. Rajadurai, Thermodynamics and Thermal Engineering New Age International (P) Ltd. Publishers.
- D.S. Kumar and V.P. Vasandani, Heat Engineering, Metropolitan Book Co. Pvt. Ltd.
- K. Soman, Thermal Engineering, PHI Learning Pvt. Ltd.
- G. Rogers and Y. Mayhew, Engineering Thermodynamics, Pearson.
- D.G. Shephered, Principles of Turbo machinery Macmillan.
- H. Cohen, G.F.C. Rogers and M. Sarvan, Gas Turbine Theory, Longmans.

BTME 405 Manufacturing Processes-II

Course Objective/s and Outcome/s: This course is designed to make students learn principles, operations and capabilities of various metal machining and metal forming processes. They will understand the importance of process variables controlling these processes. They will also recognize the inter-relationships between material properties and manufacturing processes. Upon completion of the course, the students should have the ability to select different types of the metal machining and forming processes needed for the manufacturing of various geometrical shapes of products.

Unit –I

Metal Forming: Introduction and classification. Rolling process: introduction, classification, rolling mills, products of rolling, rolling defects and remedies. Forging: open and closed die forging, forging operations, hammer forging, press forging and drop forging, forging defects, their causes and remedies. Extrusion: classification, equipment, defects and remedies. Drawing: drawing of rods, wires and tubes, draw benches, drawing defects and remedies. Sheet metal forming operations: piercing, blanking, embossing, squeezing, coining, bending, drawing and deep drawing, and spinning. Punch and die set up. Press working: press types, operations, press tools, progressive and combination dies. Process variables and numerical problems related to load calculation in Rolling, Forging, Extrusion, Drawing and Sheet metal forming. High velocity forming of metals: introduction, electro-hydraulic forming, mechanical high velocity forming, magnetic pulse forming and explosive forming. **Powder Metallurgy:** Introduction, advantages, limitations, and applications methods of producing metal powders, briquetting and sintering.

Unit –II

Metal Cutting: Introduction to machining processes, classification, Mechanics of chip formation process, concept of shear angle, chip contraction and cutting forces in metal cutting, Merchant theory, tool wear, tool life, machinability. Numerical problems based on above mentioned topics, Fundamentals of measurement of cutting forces and chip tool interface temperature. Cutting tools: types, geometry of single point cutting tool, twist drill and milling cutter, tool signature. Cutting tool materials: high carbon steels, alloy carbon steels, high speed steel, cast alloys, cemented carbides, ceramics and diamonds, and CBN. Selection of machining parameters. Coolants and lubricants: classification, purpose, function and properties.

Unit III

Machine Tools Lathe: classification, description and operations, kinematic scheme of lathe, and lathe attachments. Shaping and planing machine: classification, description and operations, drive mechanisms. Milling machine: classification, description and operations, indexing devices, up milling and down milling. Drilling machine: classification, description and operations. Boring machine: classification, description and operations. Grinding machines: classification, description and operations, wheel selection, grinding wheel composition and nomenclature of grinding wheels, dressing and truing of grinding wheels. Broaching machine: classification, description and operations. Speed, feed and machining time calculations of all the above machines.

Suggested Readings / Books:

- B. L. Juneja and G. S. Sekhon, Fundamentals of Metal Cutting & Machine Tools, New Age International (P) Ltd.
- H.S. Shan, Manufacturing Processes, Vol. I&II, , Pearson Publishers
- PC Sharma, A Text Book of Production Technology, S. Chand & Company Ltd.
- M. P. Groover, Fundamentals of Modern manufacturing, Wiley
- Serope Kalpakjian and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.

BTME 406 Fluid Mechanics LAB

1. To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter)
4. To determine the discharge coefficient for a V- notch or rectangular notch.
5. To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficients for pipes of different diameters.
8. To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9. To determine the velocity distribution for pipeline flow with a pitot static probe.
10. Experimental evaluation of free and forced vortex flow.

BTME 407 Manufacturing Processes Lab

Casting:

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding:

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot welding equipment and make weld joints by these processes.

Machining and Forming

1. To study constructional features of following machines through drawings/ sketches:
    a. Grinding machines (Surface, Cylindrical)
    b. Hydraulic Press

c. Draw Bench

d. Drawing and Extrusion Dies

e. Rolling Mills

2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
4. To prepare job on shaper involving plane surface,
5. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6. To determine cutting forces with dynamometer for turning, drilling and milling operations.

Note: At least one industrial visit must be arranged for the students for the live demonstration of Casting, Welding, Forming and Machining processes.

BTME 408 Theory of Machines Lab

1. To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.
2. To study the various inversions of kinematic chains.
3. Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor.
4. Determination of gyroscopic couple (graphical method).
5. Balancing of rotating masses (graphical method).
6. Cam profile analysis (graphical method)
7. Determination of gear- train value of compound gear trains and epicyclic gear trains.
8. To draw circumferential and axial pressure profile in a full journal bearing.
9. To determine coefficient of friction for a belt-pulley material combination.
10. Determination of moment of inertia of flywheel.

BTAM-500 MATHEMATICS-III

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

Detailed Contents

1. Fourier Series Periodic functions, Euler's formula. Even and odd functions, Change of Interval, half range expansions, Fourier series of different wave forms.

2. Laplace Transforms: Definition, Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Transform of multiplication and division by t, convolution theorem, Laplace transform of unit step function. Applications to solution of ordinary linear differential equations with constant coefficients.

3. Special Functions: Frobenius method for power series solution of differential equations, Bessel's equation, Bessel functions of the first and second kind, Legendre's equation, Legendre polynomial.

4. Partial Differential Equations: Formation of partial differential equations, Equations solvable by direct integration, Linear partial differential equations, homogeneous partial differential equations with constant coefficients. Solution by method of separation of variables, Applications: Wave equation and Heat conduction equation in one dimension. Solution of two dimensional Laplace equation (Cartesian co- ordinates).

5. Functions of Complex Variable: definition of Limit, continuity, derivative of complex functions, and analytic function. Necessary and sufficient conditions for analytic function (without proof), Cauchy-Riemann equation (Cartesian and polar co-ordinates), harmonic functions, orthogonal system, determination of conjugate functions. Miller's Thosmson method, Applications to fluid flow problems. Brief introduction to basic transformations, Bilinear transformations, complex integration: Line integrals in the complex plane, Cauchy's integral theorem, Cauchy's integral formula for analytic function and its derivatives. Taylor's and Laurent's expansions, singular points, poles, residue, Cauchy's Residue theorem, evaluation of real integrals by contour integration (F(*cosx, sinx*)

Books

1. Kreyszing Erwin, Advanced Engineering Mathematics, Wiley Eastern

2. B.S Grewal, Higher Engineering Mathematics, Khanna Publishers

3. N.K Jain, Numerical Solutions of Differential Equations, Prentice Hall

4. Sharma and Gupta, Differential Equations, Krishna Prakashan Media

5. N.P Bali , Text book of Eng Mathematics, Laxmi Publishers

BTME 501 MACHINE DESIGN-I

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

Detailed Contents

1. Meaning of design with special reference to machine design, definition and understanding of various types of design, design process, design and creativity, general design considerations, concept of tearing, bearing, shearing, crushing, bending and fracture.
2. Designation of materials according to Indian standards code, basic criteria of selection of material, mechanical properties of materials.
3. Concept of concurrent engineering in design, introduction to 'Design for X' manufacturing considerations in machine design, stress concentration, factor of safety under different loading conditions, design for static loading, design for variable loading for both limited and unlimited life, concept of fatigue and endurance strength.
4. Design of fasteners:
   Design of rivets for boiler joints, lozenge joints, eccentrically loaded joints.
   Design of spigot and socket cotter joint, gib and cotter joint and knuckle joint.
   Design of welded joints for various loading conditions in torsion, shear or direct loads, eccentrically loaded joints
5. Design of shaft and axles:
   Design of solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for rigidity, Design of axle.
6. Design of keys and couplings:
   Design of keys, design of splines, design of sleeve and solid muff coupling, clamp or compression coupling, rigid and flexible flange coupling, design of universal joint.
7. Design of levers and links:
   Design of levers(foot lever, hand lever, cranked lever, bell crank lever, safety valve lever and shoe brake lever), design of link.
8. Design of pipe joints:
   Stresses in pipe joints, design of pipe joints with oval flange, square flange, design of seals and gaskets.

   Books

   1. Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill
   2. Robert C. Juvinall Fundamentals of machine component design, Wiley
   3. V.K Jadon, Analysis and design of machine elements, I.K. International
   4. V.B Bhandari, Design of Machine elements, Tata Mc. Hill
   5. S.S Jolly, Design of machine elements-I, Dhanpat Rai and Co.

Following is a sample list of problems which may be used for Tutorials

1. Select a daily use product and design the conceptual design by applying the design process talking the controlling parameters

2. Make a list of mechanical components and know their materials and suggest some alternative materials for the each one of them

3. Design a wall bracket, which is being used in real life by actual measurement of load

a) Welded joints

b) Riveted and bolted joints

And justify your findings

4. Find a flange coupling in the college laboratory and justify its design by actual measurements

5. Design a shaft used in some practical application, by actual working and loading conditions

6. Select a braking system lever (both hand and foot lever) and justify the design parameters

7. Justify the design of single plate clutch of an engine assembly

Note: 1. Design data book compiled by PSG college of Engg. & Tech., Coimbatore is allowed in Examination.

Note: 2 Guide lines regarding paper setting:

Part A- 10 questions of 2 marks each. All compulsory.

Part B- There will be 6 questions of 10 marks each. Candidate will be required to attempt any four questions.

BTME 502 COMPUTER AIDED DESIGN AND MANUFACTURING

Internal Marks: 40 External Marks: 60 Total Marks: 100

Detailed Contents

1. Fundamentals of CAD;

Design process with and without computer; CAD/CAM system and its evaluation criteria, brief treatment of input and output devices, Display devices; Functions of a graphics package and Graphics standard GKS, IGES and STEP; Modeling and viewing; Application areas of CAD.

2. Geometric Transformations:

Mathematics preliminaries, matrix representation of 2 and 3 dimensional transformation: Concatenation of transformation matrices. Application of geometric transformations.

3. Geometric Modeling:

Wireframe model: solid modeling: Boundary Representation (B-rep), Constructive Solid Geometry (CSG), Parametric Modeling Technique ; Mass , volumetric properties calculations; surface modeling, concepts of hidden-line removal and shading: Mechanical Assembly Kinematics analysis and simulation.

4. Representation of curves and surfaces:

Non-parametric and parametric representation of curves. Parametric representation of Hermite Cubic, Beizer and B-spline curves; Surface and its analysis. Representation of Analytical and synthetic surfaces.

5. Overview of FEM, Advantages and applications, recent advance in FEM, FEA software Basic principles and general procedure of FEM.

6. NC/CNC Machine Tools;

NC machine tools- basic components, coordinate systems; features of NC machine tools. Computerized Numerical Control (CNC): Tooling for NC machines - tool presetting equipment, flexible tooling, tool length compensation, tool path graphics; NC motion control system; Manual part programming, fixed/floating zero. Block format and codes: Computer assisted part programming. DNC and Adaptive Control: Direct numerical control: Adaptive control in machining system; Combined DNC/CNC system.

7. Group Technology (GT):

Part families; part classification and coding system: Group technology machine cells: Advantages of GT.

8. Computer Aided Process Planning:

Introduction and benefits of CAPP. Types of CAPP systems, machinability, data selection systems in CAPP.

9. Computer Integrated Manufacturing Systems:

Basic Concepts of CIM: CIM Definition, The meaning of Manufacturing, Types of Manufacturing systems; Need, Elements, Evolution of CIM; Benefits of CIM; Flexible Manufacturing Systems: Physical Components of an FMS. Types of Flexibility, Layout Considerations; FMS benefits.

Books:

1. Mikell P. Groover, Emory W. Zimmers, CAD/CAM, PHI

2. D.D. Bedworth, M.R Henderson & P.M. Wolfe, Computer Integrated Design and Manufacturing, Tata McGraw Hill

3. Zeid Ibraham, CAD/CAM - theory and Practice, Tata McGraw Hill

4. P. N Rao, CAD/CAM, Tata McGraw Hill

5. C. Elanchezhian, G. Shanmuga Sundar, Computer aided manufacturing (CAM), Firewall Media

BTME 503 MECHANCIAL MEASUREMENTS AND METROLOGY

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. General Concepts

Need and classification of measurements and instruments; basic and auxiliary functional elements of a measurement system; Mechanical versus electrical / electronic instruments; primary, secondary and working standards.

2. Static and Dynamic Characteristics of Instruments

Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. Zero, first and second order systems and their response to step, ramp and sinusoidal input signals.

3. Errors in Measurement

Sources of errors, systematic and random errors; statistical analysis of test-data, probable error and probability tables, rejection of test data, error propagation; Design and planning of experiments and report writing.

4. Metrology

Line, end and wavelength standards; linear measurements - vernier scale and micrometer, vernier height gauge and depth guage; comparators - their types, relative merits and limitations; Angular measurements - sine bar, clinometer, angle guage; concept and measurement of straightness and flatness by interferometry; surface roughness - specifications and measurement, Measurement of major diameter, minor diameter, effective diameter, pitch, angle and form of threads for internal and external threads; measurement of tooth thickness, pitch and checking of profile for spur gears.

5. Functional Elements

Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pick ups, photo cells and piezo-electric transducers and application of these elements for measurement of position / displacement, speed / velocity / acceleration, force and liquid level. Resistance strain guages, guage factor, bonded and unbonded guages, surface preparation and bonding technique signal conditioning and bridge circuits, temperature compensation, application of strain guages for direct, bending and torsional loads. Introduction to amplifying, transmitting and recording devices.

6. Pressure and Flow Measurement

Bourdon tube, diaphragm and bellows, vacuum measurement - Mcleod guage, thermal conductivity guage and ionisation guage; Dead weight guage tester. Electromagnetic flux meters, ultra-sonic flow meters and hot wire anemometer: flow visualisation techniques.

7. Temperature Measurement

Thermal expansion methods - bimetallic thermometers, liquid-in-glass thermeter and filled-in-system thermometers; thermo-electric sensors - common thermo couples, reference junction considerations, special materials and configurations; metal resistance thermometers and thermistors; optical and total radiation pyrometers; calibration standards.

8. Speed, Force, Torque and Shaft Power Measurement

Mechanical tachometers, vibration reed tachometer and stroboscope; proving ring, hydraulic and pneumatic load cells, torque on rotating shafts; Absorption, transmission and driving dynamo meters.

Books

1. E.O Doebelin, Measurement System: Application and Design, McGraw Hill

2. J.P Holman, Experimental Methods for Engineers, McGraw Hill

3. D.S Kumar, Mechanical Measurement and Control, Metropolitan Book Co.

4. R.K Jain, Engineering Metrology, Khanna Publishers

5. B.C Kuo, Automatic Control systems, Prentice Hall

BTME 504 INDUSTRIAL AUTOMATION AND ROBOTICS

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

Detailed Contents

1. Introduction:
   - Concept and scope of automation:
   - Socio economic impacts of automation
   - Types of Automation, Low Cost Automation
2. Fluid Power:
   - Fluid power control elements
   - Standard graphical symbols
   - Fluid power generators
   - Hydraulic and pneumatic Cylinders - construction, design and mounting;
   - Hydraulic and pneumatic Valves for pressure, flow and direction control:
3. Basic hydraulic and pneumatic circuits:
   - Direct and Indirect Control of Single/Double Acting Cylinders
   - Designing of logic circuits for a given time displacement diagram & sequence of operations,
   - Hydraulic & Pneumatic Circuits using Time Delay Valve & Quick Exhaust Valve
   - Memory Circuit & Speed Control of a Cylinder
   - Troubleshooting and "Causes & Effects of Malfunctions"
   - Basics of Control Chain
   - Circuit Layouts
   - Designation of specific Elements in a Circuit
4. Fluidics:
   - Boolean algebra
   - Truth Tables
   - Logic Gates
   - Coanda effect
5. Electrical and Electronic Controls
   - Basics of Programmable logic controllers (PLC)
   - Architecture & Components of PLC
   - Ladder Logic Diagrams
6. Transfer Devices and feeders:
   - Classification, Constructional details and Applications of
   - Transfer devices
   - Vibratory bowl feeders
   - Reciprocating tube
   - Centrifugal hopper feeders
7. Robotics
   - Introduction,

Classification based on geometry, control and path movement,
Robot Specifications, Robot Performance Parameters
Robot Programming
Machine Vision, Teach pendants
Industrial Applications of Robots

Books

1. Anthony Esposito, Fluid Power with applications, Pearson
2. S. R Majumdar, Pneumatic Control, McGraw Hill
3. S. R Deb, Robotic Technology and Flexible Automation, Tata Mc Hill
4. Saeed B. Niku Introduction to Robotics, Wiley India
5. Ashitava Ghosal, Robotics, Oxford

BTME 505 AUTOMOBILE ENGINEERING

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Introduction

Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit.

2. Power Unit

Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system, silencers, types of pistons and rings

3. Fuel Supply System

Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of Carter carburetors and fuel injection systems; MPFi (Petrol), Diesel fuel system - cleaning, injection pump, injector and nozzles, Common Rail fuel supply system

4. Lubrication and Cooling Systems

Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

5. Chassis and Suspension

Loads on the frame, considerations of strength and stiffness, engine mounting, independent suspension systems (Mac Pherson, Trailing Links, Wishbone), shock absorbers and stabilizers; wheels and tyres, tyre wear types, constructional details of plies

6. Transmission system

Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission

7. Steering System

Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering, Ball re-circulating mechanism

8. Braking System

General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances

9. Electric System

Classification, Introduction to Conventional and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements: voltage and current regulation

10. Maintenance

Preventive maintenance, trouble shooting and rectification in different systems; engine tuning and servicing, major tools used for maintenance of automobiles

Books

1. W.H Crouse, Automotive mechanics, McGraw Hill

2. J. Heitner, Automotive Mechanics, East West Press

3. Kirpal Singh, Automobile Engineering Vol. I and II, Standard Publishers

4. J. Webster, Auto Mechanics, Glencoe Publishing Co.

5. P.S Gill, Automobile Engineering, S.K Kataria

BTME506 COMPUTER AIDED DESIGN AND MANUFACTURING LAB

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

1. Introduction to modeling (using any CAD software):

1. 2D drawing using sketcher – 2 Drawings 2 Hrs

2. 3D modeling using 3D features (Modeling of Crane Hook, Bench Vice, Screw Jack components) 4 Hrs

3. Assembling and drafting (any 2 above mentioned assemblies) with proper mating conditions and interference checking. 4 Hrs

4. Surface modeling – (Computer mouse, Plastic bottles with spraying Nozzle) 4 Hrs

2. Computer Aided Manufacturing:

1. Manual part programming on CNC Lathe and CNC Milling – (4 programs, 2 for each) 4 hrs

2. Computer Aided Part programming for CNC Lathe and CNC Milling to generate tool path, NC code, and Optimization of tool path (to reduce machining time) using any CAM software. 4Hrs

BTME 507 MECHANICAL MEASUREMENTS AND METROLOGY LAB

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

1. Measurement of an angle with the help of sine bar
2. Measurement of surface roughness of a machined Plate, Rod and Pipe
3. Measurement of gear elements using profile projector
4. Measurement of effective diameter of external threads using Three wire method
5. Measurement of thread element by Tool makers microscope
6. Calibration of a pressure guage with the help of a dead weight guage tester
7. Use of stroboscope for measurement of speed of shaft
8. Use of pitot tube to plot velocity profile of a fluid through a circular duct
9. Preparation of a thermocouple, its calibration and application for temperature measurement

BTME 508 INDUSTRIAL AUTOMATION AND ROBOTICS LAB

Internal Marks: 15 **External Marks: 10** **Total Marks: 25**

1. Design and assembly of hydraulic / pneumatic circuit.

2. Demonstration and working of power steering mechanism

3. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves

4. Use of direction control valve and pressure control valves clamping devices for jig and fixture

5. Study of robotic arm and its configuration

6. Study the robotic end effectors

7. Study of different types of hydraulic and pneumatic valves

BTME 509 AUTOMOBILE ENGINEERING LAB

Internal Marks: 15 **External Marks: 10** **Total Marks: 25**

1. Valve refacing and valve seat grinding and checking for leakage of valves

2. Trouble shooting in cooling system of an automotive vehicle

3. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap

4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.

5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.

6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.

7. Replacing of ring and studying the method of replacing piston after

6th Semester

BTME 601 DESIGN OF MACHINE ELEMENTS -II

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Transmission Drives

Belt and rope drives: Basics, Characteristics of belt drives, selection of flat belt, Design of Flat belt, V-belt and rope (steel wire), Design of the pulley for the same

Chain Drives: Basics, Roller chains, polygonal effect, power rating, selection of chain

Gear drives: Standard system of gear tooth and gear module, gear tooth failure, strength of gear tooth, terminology of spur, helical, bevel, worm and worm wheel, Design of spur, helical, straight bevel gears, worm and worm wheel

2. Bearings

Slider: Principle of hydrodynamic lubrication, modes of lubrication, Reynolds equation, bearing performance parameters, slider bearing design

Roller: Types, selection guidelines, static and dynamic load carrying capacity, Stribeck's equation, equivalent bearing load, load life relationship, selection of bearing, comparison of roller and slider bearing

3. Design of Flywheel

Introduction, Energy stored in a flywheel, stresses in a rim, design considerations

4. Springs

Types; end styles of helical compression spring; stress and deflection equation; surge in spring; nipping of leaf spring; Design of close-coil helical spring and multi leaf spring

5. Clutches

Design of contact clutches i.e. plate, multi-disc, cone and centrifugal clutches.

6. Brakes

Design of band, disc, block with shoe and internal expanding brakes.

Books

a. Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill

b. Robert C. Juvinall Fundamentals of machine component design, JohnWiley Eastern
c. V.K Jadon, Analysis and design of machine elements, I.K. International
d. V.B Bhandari, Design of Machine elements, Tata Mc-Graw. Hill
e. S.S Jolly, Design of machine elements-II, Dhanpat Rai and Co.

Following is the list of sample tutorial problems for design practice to be given to the students:

1. Find an assembly containing the belt and pulley mechanism and do the complete design calculations and then justify the existing design.

2. Design a transmission system involving the chain drives / gear drives by specifying inputs, and then justify design.

3. Design completely a hydrodynamic journal bearing and specify its suitability by using heat balance equation.

4. Select a suitable roller bearing for a particular application.

5. Design flywheel for industrial application and suggest its suitability.

6. Design springs for automobile application by specifying conditions and constraints.

7. Design a clutch and brakes of an automobile and justify its suitability.

Note:1 Design data book compiled by PSG college of Engg. & Tech., Coimbatore is allowed in examination.

Note: 2 Guide lines regarding paper setting:

Part A- 10 questions of 2 marks each. All compulsory.

Part B- There will be 6 questions of 10 marks each. Candidate will be required to attempt any four questions.

BTME-602 HEAT TRANSFER

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Introduction:

Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics". Different modes of heat transfer - conditions, convection, and radiation.

2. Conduction:

Fouier's law of heat conduction, coefficient of thermal conductivity, effect of temperature and pressure on thermal conductivity of solids, liquids and gases and its measurement. Three-dimensional general conduction equation in rectangular, cylindrical and spherical coordinates involving internal heat generation and unsteady state conditions. Derivation of equations for simple one dimensional steady state heat conduction from three dimensional equations for heat conduction though walls, cylinders and spherical shells (simple and composite), electrical analogy of the heat transfer phenomenon in the cases discussed above. Influence of variable thermal conductivity on conduction through simple cases of walls / cylinders and spheres. Equivalent areas, shape factor, conduction through edges and corners of walls and critical thickness of insulation layers on electric wires and pipes carrying hot fluids. Internal generation cases along with some practical cases of heat conduction like heat transfer through piston crown, through under-ground electrical cables/Hot fluid pipes etc and case of nuclear fuel rod with and without cladding. Introduction to unsteady heat transfer, Newtonian heating and cooling of solids; definition and explanation of the term thermal diffusivity. Numerical.

3. Theory of Fins:

Concept of fin, classification of fins and their applications. Straight fins of uniform cross-section; e.g. of circular, rectangular or any other cross-section). Straight fins with varying cross-sectional area and having triangular or trapezoidal profile area. Circumferential fins of rectangular cross-section provided on the circumference of a cylinder. Fin performance: fin effectiveness and fin efficiency, total fin effectiveness, total fin efficiency. Optimum design of straight fin of rectangular and triangular profile area. Application of fins in temperature measurement of flow through pipes and determination of error in its measurement. Numerical.

4. Convection:

Free and forced convection. Derivation of three-dimensional mass, momentum and energy conservation equations (with introduction to Tensor notations).

Boundary layer formation, laminar and turbulent boundary layers (simple explanation only and no derivation). Theory of dimensional analysis and its application to free and forced convective heat transfer. Analytical formulae for heat transfer in laminar and turbulent flow over vertical and horizontal tubes and plates. Numerical.

Newton's law of cooling. Overall coefficient of heat transfer. Different design criterion for heat exchangers. Log mean temperature difference for evaporator and condenser tubes, and parallel and counter flow heat exchangers, Calculation of number and length of tubes in a heat exchanger effectiveness and number of transfer units(NTU); Numerical.

5. Convection with Phase Change (Boiling and Condensation):

Pool boiling, forced convection boiling, heat transfer during pool boiling of a liquid. Nucleation and different theories of nucleation, different theories accounting for the increased values of h.t.c. during nucleate phase of boiling of liquids; different phases of flow boiling (theory only), Condensation, types of condensation, film wise condensation on a vertical and inclined surface, Numerical.

6. Radiation:

Process of heat flow due to radiation, definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies, Plank's law of nonchromatic radiation. Kirchoff's law and Stefan Boltzman's law. Interchange factor. Lambert's Cosine law and the geometric factor. Intensity of Radiation (Definition only), radiation density, irradiation, radiosity and radiation shields. Derivation formula for radiation exchange between two bodies using the definition of radiosity and irradiation and its application to cases of radiation exchange between three or four bodies (e.g. boiler or other furnaces), simplification of the formula for its application to simple bodies like two parallel surfaces, concentric cylinders and a body enveloped by another body etc. Error in Temperature measurement by a thermocouple probe due to radiation losses.

Books:

1. Frank P. Incropera and David P. De Witt, Fundamentals of Heat and Mass transfer, John Wiley
2. P.S. Ghoshdastidar, Heat Transfer, Oxford Press
3. D.S. Kumar, Fundamentals of Heat and Mass Transfer, SK Kataria & Sons ($6^{th}/7^{th}$ Edition)
4. A.J. Chapman, Heat Transfer, McGraw Hill Book Company, New York.
5.J.P. Holman, Heat Transfer, Tata McGraw-Hill Publishing Company Ltd.(Special Indian Edition).
6. Yunus A.Cengel, Heat and Mass Transfer, Tata McGraw Hills Education Private Ltd (Special Indian Edition).
7. Eckert & Drake, Heat and Mass Transfer, McGraw Hill Book Company, New York.

BTME 603 FLUID MACHINERY

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. General Concepts:

Impulse momentum principle; jet impingement on stationary and moving flat plates, and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted, work done and efficiency of jet.

Basic components of a turbo machine and its classification on the basis of purpose, fluid dynamic action, operating principle, geometrical features, path followed by the fluid and the type of fluid etc. Euler's equation for energy transfer in a turbo machine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes.

2. Pelton Turbine:

Component parts and operation; velocity triangles for different runners, work output; Effective head, available power and efficiency; design aspects such as mean diameter of wheel, jet ratio, number of jets, number of buckets with working proportions

3. Francis and Kaplan Turbines:

Component parts and operation velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes - its function and types. Function and brief description of commonly used surge tanks, Electro- Mechanical governing of turbines

4. Centrifugal Pumps:

Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump - suction, delivery and manometric heads; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; Priming and priming devices, Multistage pumps - series and parallel arrangement; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems, causes and remedies.

5. Similarity Relations and Performance Characteristics:

Unit quantities, specific speed and model relationships, scale effect; cavitation and Thoma's cavitation number; Concept of Net Positive Suction Head (NPSH) and its application in determining turbine / pump setting

6. Reciprocating Pumps:

Components parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Air vessels

7. Hydraulic Devices and Systems:

Const., operation and utility of simple and differential accumulator, intensifier, fluid coupling and torque converter, Air lift and jet pumps; gear, vane and piston pumps, Hydraulic Rams

Books:

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill

2. Jagdish Lal, Hydraulic Machines by Metropolitan Book Co

3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,

4. K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill

5. R.K. Purohit., Hydraulic Machines, Scientific Publishers

BTME-604 STATISTICAL AND NUMERICAL METHODS

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Data, its Arrangements and Measures:

Introduction: Data, Data Array; Frequency Distribution Construction and Graphic representation. Mean, median, mode and standard deviation.

2. Probability and Probability Distributions:

Introduction: Definition probability and Probability Distribution; Conditional probability; Random variables, Poisson, Normal and Binomial distributions.

3. Sampling and Sampling Distributions:

Introduction: Fundamentals of Sampling, Large samples, small samples; Normal sampling distributions; Sampling distribution of the means, t-Distribution, F-Distribution, Chi-square Distribution.

4. Errors in Numerical Calculations:

Errors and their analysis, general error formula, errors in a series approximation

5. Solution of Algebraic and Transcendental Equations:

Bisection method, iteration method, Method of false position,, Newton -Raphson method, solution of systems of non linear equations.

6. Interpolation Method:

Finite difference, forward, backward and central difference, Difference of polynomial, Newton's formulae for interpolation, central difference interpolation formulae, Interpolation with unevenly spaced points, Newton's general interpolation formula, interpolation by iteration.

7. Numerical Differentiation and Integration:

Numerical differentiation, maximum and minimum values of a tabulated function; Numerical Integration-trapezoidal rule, Simpson1/3 rule, Simpsons 3/8 rule, Newton-cots integration formulae; Euler-Meclaurin formula, Gaussian integration(One dimensional only)

8. Solution of Linear Systems of Equations:

Gauss Elimination method (fall and banded symmetric and unsymmetric systems), Gauss Jordon method. Eigen value problems (Power method only).

9. Numerical solution of ordinary and partial differential equations:

Solution by Taylor's series, Prediction -correction method, Boundary value problems, Prediction corrector method, Euler's and modified Euler's method, Runge-Kutta method, finite difference methods. Finite difference approximation to derivatives, Solution to Laplaces equation- Jacobi's method, Gauss -Siedel method.

Note: The students are required to develop computer programs (using any high level language) for different Numerical Methods as part of assignment work.

Books:

1. S. S. Sastry, Introductory methods of numerical analysis by: Prentice Hall of India

2. V. RajaRaman, Computer Oriented Numerical Methods-

3. S.D. Conte, Cari De Boor, Elementary Numerical Analysis, Mc Graw Hill.

4. B. Cornahn, Applied Numerical Methods, John Wiley.

5. Richard I. Levin, S. David., Rubin Statistics for Management, Pearson.

BTME 605 HEAT TRANSFER LAB.

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

A. Two to three students in a group are required to do one or two practicals in the form of Lab. Project in the topic/s related to the subject matter and in consultation with teacher. The complete theoretical and experimental analysis of the concerned topic is required to be performed (including design and fabrication of new experimental set up, if required, or modifications/retrofitting in the existing experimental set ups). The following topics can be taken as reference:-

1. Determination of thermal conductivity of:

   - a solid insulating material by slab method

   - powder materials by concentric spheres method / or by some transient heat transfer technique

   - a metal by comparison with another metal by employing two bars when kept in series and / or in parallel under different boundary conditions

   - Liquids by employing thin layer

2. Determination of coefficient of heat transfer for free/forced convection from the surface of a cylinder / plate when kept:

   a) along the direction of flow

   b) perpendicular to the direction of flow

   c) inclined at an angle to the direction of flow

3. To plot the pool boiling curves for water and to determine its critical point

4. Determination of heat transfer coefficient for

   i) film condensation ii) drop-wise condensation

5. Determination heat transfer coefficient by radiation and hence find the Stefan Boltzman's constant using two plates/two cylinders of same size by making one of the plates/cylinders as a black body.

6. Determination of shape factor of a complex body by an analog technique.

7. To plot the temperature profile and to determine fin effectiveness and fin efficiency for

   i) A rod fin when its tip surface is superimposed by different boundary condition like.

a) Insulated tip

b) Cooled tip

c) Temperature controlled tip

ii) Straight triangular fins of various sizes and optimization of fin proportions

iii) Circumferential fins of rectangular/triangular section

B. Each student is required to use Finite Difference Method for analysis of steady state one dimensional and two dimensional conduction problems (Minimum two problems one may be from the Lab. Project) such as conduction through plane/cylindrical/spherical wall with or without internal heat generation, heat transfer through fins, bodies with irregular boundaries subjected to different boundary conditions.

BTME 606 FLUID MACHINERY LAB

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

1. Determination of various efficiencies of Hydraulic Ram

2. To draw characteristics of Francis turbine/Kaplan Turbine

3. To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance

4. To draw the characteristics of Pelton Turbine

5. To draw the various characteristics of Centrifugal pump

6. Determine the effect of vane shape and vane angle on the performance of centrifugal fan/Blower

7. A visit to any Hydroelectric Power Station

7th /8th semester

BTME 801 INDUSTRIAL ENGINEERING & MANAGEMENT

1. Introduction:

Definition and scope of industrial engineering, Functions of industrial engineering department and its organization, Qualities of an industrial engineer, concept of production and productivity.

2. Concepts of Management:

Functions of Management, Evolution of Management Thought : Taylor's Scientific Management, Fayol's Principles of Management, Douglas Mc-Gregor's Theory X and Theory Y, Mayo's Hawthorne Experiments, Hertzberg's Two Factor Theory of Motivation, Maslow's Hierarchy of Human Needs – Systems Approach to Management.

3. Designing Organizational Structures:

Concept, Importance and characteristics of organization, Types of organization - Project, matrix and informal organization. Span of control, Delegation of authority.

4. Management Planning, Decision Making and Control:

Steps, hierarchy, principles and dimensions of planning function, Approaches to decision making, Decision support systems, Basic control process, control parameters, principles of control.

5. Plant Location & Layout:

Plant location: definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection. Plant layout**:** Needs for a good layout, Different types viz. Product, process and combination layouts, Introduction to layouts based on the GT, JIT and cellular manufacturing systems, Development of plant layout.

6. Productivity:

Definition, reasons for low productivity, methods to improve productivity, relation between work-study and productivity.

7. Work Analysis:

Definition, need and scope of Work Analysis. Method-study: Definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Principles of motion economy; Development and installation of new method. Work–measurement: Definition, various techniques of work-measurement such as work-sampling, stopwatch time study & its procedure, Job selection, Equipment and Forms used for work measurement, need for rating operator, methods of rating, allowances and their types, standard time. Standard data techniques.

8. Value Engineering:

Definition, Types of values, concept, phases and application of value engineering.

Books:

1. **Philip E** Hick, Industrial Engineering & Management, Tata McGraw Hill
2. Lawrence D. Miles, Techniques of Value Analysis and Engineering, McGraw Hill.
3. R.N. Nauhria, Rajnish Parkash, Management of Systems, Wheeler Publishers
4. S. Buffa, Modern Production Management, Wiley Eastern
5. H.S. Shan, Work Study and Ergonomics, Dhanpat Rai and Co. (P) Ltd.

BTME 802 REFRIGERATION AND AIRCONDITIONING

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

1. Basic Concepts:

Definition of Refrigeration and Air conditioning; Difference between Refrigeration and cooling; Difference between Refrigeration and Air conditioning; Brief history of Refrigeration and Air conditioning; Natural and Mechanical Refrigeration; Applications of Refrigeration and Air conditioning; Definitions of refrigerant, cooling/ Refrigeration effect, cooling capacity, heating effect, heating capacity; Units of refrigeration; Coefficient of performance and Energy Efficient Ratio; COP of a refrigerator; and COP/EPR of a heat pump; Single Phase Reversed Carnot cycle and its limitations; Two Phase Reversed Carnot cycle and its limitations; Methods of Refrigeration; Numerical.

2. Gas Cycle Refrigeration and Aircraft Refrigeration & Air conditioning:

Bell Coleman/Reversed Brayton/ Reversed Joule Cycle and its analysis; Numerical; optimum COP and pressure ratio (No mathematical Analysis); Applications of Gas Cycle Refrigeration; Necessity of aircraft refrigeration and air conditioning; Classification of aircraft refrigeration and air conditioning systems; Simple/basic aircraft refrigeration and air conditioning system (with and without evaporative cooler); Need of evaporator cooler; Boot Strap aircraft refrigeration and air conditioning system (with and without evaporative cooler); Regenerative aircraft refrigeration and air conditioning system; Reduced Ambient aircraft refrigeration and air conditioning system; Dry Air Rated Temperature (DART); Comparison of different aircraft refrigeration and air conditioning systems; Numerical.

3. Vapour Compression Refrigeration Cycle:

Vapour compression refrigeration system and its basic components; Representation of Simple/ TheoreticaL vapour compression refrigeration cycle on P-v, T-s and P-h diagrams; Dry versus wet compression; expansion versus throttling of liquid refrigerant; Analysis of Simple/Theoretical vapour compression refrigeration cycle; Introduction of P-h diagram/chart and Refrigeration Tables; Determination of properties of sub cooled, saturated and superheated refrigerant by using saturated properties & specific heat tables/saturated & superheated properties tables and P-h diagram; Compressor work and volumetric efficiency; Effect on performance and cooling capacity due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours, use of liquid - vapour regenerative heat exchanger; Effect on performance and cooling capacity due to heat exchange of vapours with compressor cylinder walls, pressure drop in suction (wire drawing) and discharge valves, pressure drop in evaporator and condenser; Actual vapour compression refrigeration cycle on T-s and P-h diagrams (No mathematical analysis); Numericals. Flash gas, its advantages and disadvantages, and its removal: flash chamber, liquid sub-cooler; Brief introduction (no mathematical analysis) to compound (multistage) compression, its advantages, schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, liquid sub-cooler (independent and combination of these); Brief introduction (no mathematical analysis) to multiple evaporator systems, schematic representation of these systems with use of individual and multiple expansion valves arrangements, with single and multiple (individual and compound) compressor.

4. Vapour Absorption Refrigeration Cycle (No Mathematical Analysis):
Principle of vapour absorption refrigeration; basic components of the vapour absorption refrigeration system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system (Single and double effect);Electrolux refrigeration system; comparison between vapour absorption and compression systems.

5. Refrigerants:
Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Zeotropes; Effect of moisture and oil miscibility; Refrigerants dying agents and antifreeze solution; leak detection and charging of refrigerants; environmental aspects of conventional refrigerants; Ecofriendly refrigerants and action plan to reduce ecological hazards.

6. Alternative Refrigeration Systems and Low Temperature Refrigeration:
(No Mathematical Analysis)
Steam Jet Refrigeration; Mixed Refrigeration Systems; Vortex Tube Refrigeration, Thermoelectric cooling; Transcritical Carbon Dioxide Compression Refrigeration; Cascade Refrigeration System; Linde and Claude cycles, cryogenics and its engineering applications.

7. Air Conditioning Concepts and Applications:
Psychrometry; Dry Air; Moist Air; Basic laws obeyed by Dry Air and Moist Air; Psychrometric properties of air: Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; Psychrometric chart and its use; Adiabatic mixing of moist air streams without condensation and with condensation; Numerical.
Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

8. Psychometric Processes:
Basic psychrometric processes; Sensible heat process; Latent heat process;Total heat process; Sensible heat factor; Evaporative cooling; cooling with dehumidification; Heating with dehumidification; chemical dehumidification; By-pass factor; Contact factor; Psychrometric processes in air conditioning equipment: Cooling coils, Heating coils, cooling and dehumidification coils, Evaporative coolers, Adiabatic dehumidifiers, Steam injection, Air washer; Numerical.

9. Calculations for Air conditioning Load and for Rate and state of Supply Air:
Sources of heat load; sensible and latent heat load; Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises; Numerical

10. Refrigeration and Air Conditioning Equipment:
Brief description of compressors, condensers, evaporators and expansion devices; Cooling towers; Ducts; dampers; grills; air filters; fans; room air conditioners; split units; Package and central air conditioning plants.

Books:

1. C.P. Arora, Refrigeration and Conditioning, Tata McGraw Hill
2. Manohar Prasad, Refrigeration and Conditioning, Wiley Eastern Limited
3. Jordan and Priester, Refrigeration and Conditioning, Prentice Hall of India
4. W.F. Stoecker, Refrigeration and Conditioning, McGraw Hill

BTME 803 MECHANICAL VIBRATIONS

Internal Marks: 40 **External Marks: 60** **Total Marks: 100**

Detailed contents

1. Introduction:

Basic concepts, Types of vibration, Periodic & Harmonic vibrations, Methods of vibration analysis

2. Vibration of Single Degree of Freedom System:

Undamped free vibrations, damped free vibrations and damped force vibration system, Modelling of stiffness and damping (both viscous and coulomb), estimation of damping by decay plots, vibration isolation transmissibility, vibration measuring instruments.

3. Two degrees of Freedom systems:

a) Principal modes of vibrations, natural frequencies, amplitude ratio, undamped free, damped free, forced harmonic vibration, semi-definite systems, combined rectilinear & angular modes; Lagrange's equation.

b) Application to un-damped and damped absorbers: Vibration absorber – principle; centrifugal pendulum vibration absorber, torsional vibration damper, untuned dry friction and viscous vibration damper, torsional vibration abosrber.

4 Multi-degree of freedom systems:

Undamped free vibrations, influence coefficients, Generalised coordinates, orthogonality principal, matrix iteration method, Rayleigh and Dunkerley, Holzer's , Stodola method, Eigen values and eigen vectors

5. Continuous systems:

Lateral vibrations of a string, longitudinal vibrations of bars, transverse vibrations of beams, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts

Books:

1. G.K. Grover, Mechanical Vibrations Hem Chand and Bros

2. K.K. Purjara, Mechanical Vibrations, Dhanpat Rai and Sons, Delhi

3. V.P.Singh, Mechanical Vibrations Dhanpat Rai and Sons, Delhi

4. Debabrata Nag, Mechanical Vibration, John Wiley India

5. Thomson, Mechanical Vibration, Prentice Hall

BTME 804 REFRIGERATION AND AIRCONDITIONING LAB

Internal Marks: 30 **External Marks: 20** **Total Marks: 50**

1. Study of various elements of a vapour compression refrigeration system through cut sections models / actual apparatus.
2. Study and performance testing of domestic refrigerator.
3. Study the performance testing of Electrolux refrigerator.
4. Study and performance testing of an Ice plant.
5. Calculation/ Estimation of cooling load for a large building.
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning
7. Visit to a cold storage for study of its working.
8. Study and performance testing of window type room air conditioner.
9. Study and performance testing of water cooler.

Subjects for Departmental Electives

Group-I

DE/ME-1.1 I. C. Engines

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to IC Engines:

Definition of engine; Heat Engine, Historical Development of IC Engines, Classification & Nomenclature, Application of IC Engines, Air Standard Cycle, Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel cycle, Dual Cycle, Thermodynamics Analysis of these cycles.

2. Actual Working of I.C. Engine:

Working of 4 stroke petrol & diesel engines and their valve timing diagram, working of 2-stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, Actual working of 2 & 4 stroke gas engine and their valve diagram.

3. Fuel Air Cycles and their analysis:

Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, Dissociation, effect of no. of moles, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; Difference between Actual and Fuel-Air Cycle, Actual and Fuel-Air Cycles for S.I. and C.I. Engines.

4. IC Engine Fuels:

Introduction, types of fuels, solid, liquid and gaseous fuels, chemical structure of petroleum, petroleum refining process, important qualities of S.I. & C.I. Engine fuels and their rating. Combustion of fuels; Calorific valves of fuels, theoretical determination of CV of fuel, combustion equation for hydrocarbon fuels, determination of minimum air required for combustion, conversions of volumetric analysis of mass analysis, Determination of air supplied from volumetric analysis of Dry flue gases, Determination of excess air supplied , Determination of % of carbon in fuel burning to CO & CO_2 , Determination of minimum quantity of air supplied to gaseous

5. Fuel Supply System:

Fuel Supply System and fuel pumps, properties of air fuel mixture, a sample carburetor an its working, approximate analysis of simple carburetor, Actual air fuel ratio of single jet carburetor, Exact analysis of single jet carburetor, ideal requirements from a carburetor, limitations of single jet carburetor, different devices used to meet the requirements of an ideal carburetor. Different modern carburetors, introduction to petrol injection, fuel injection systems for C.I.

6. Engines:

classification of injection systems, injection pump, injection pump governor, mechanical governor, fuel injection systems, injection pump Governor, Mechanical Governor, Fuel Injector, Nozzle, Injection of S.I. Engines, Fuel Filters.

7. Combustion in S.I. Engines:

Introduction, Stages of Combination in S.I. Engine, Flame font propagation, factor influencing the flame speed, ignition lag and factors affecting the lag, Abnormal combustion and knocking, control and measurement of knock, rating of S.I. Engine fuels and anti knock agents, combustion chambers of S.I. Engines

8. Supercharging:

Introduction, purpose of supercharging, type of superchargers, analysis of superchargers, performance of superchargers, Arrangement of Supercharger and its installation, Turbo charged engines, supercharging of S.I. & C.I. Engines. Limitations of supercharging.

9. Measurement and Testing:

Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps

Books:

1. V. Ganesan, Internal Combustion Engines, Prentice Hall.

2. V. M. Damundwar, A Course in Internal Combustion Engines, Dhanpat Rai.

3. John B. Heywood, Internal combustion engine fundamentals McGraw-Hill,

4. Colin R. Ferguson, Allan Thomson, Kirkpatrick Internal combustion engines: applied thermo sciences, John Wiley & Sons

5. Richard Stone, Introduction to Internal Combustion Engines Society of Automotive Engineers,

DE/ME-1.2 CRYOGENIC TECHNOLOGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

PART - I

1. History of cryogenic engineering; application of cryogenics

2. Properties of Oxygen, Nitrogen and Argon, and Hydrogen, Helium and rare gases

3. Thermal, mechanical and electrical properties of engineering materials at low temperature: Introduction to the phenomenon of superconductivity and its applications

PART - II

3. Thermodynamics of ideal liquefaction cycles; Joule-Thomson effect 3 Linde cycle; prncooled linde cycle; exercise

4. Claude, Heylandt, and kapitza cycles; exercises

5. Liquification of hydrogen and helium

PART-III

Heat exchangers and definition of effectiveness

1 Coiled tube (hampson type) and brazed Aluminum heat exchangers

2 Cryogenic expansion engines and turbines

PART -IV

1. Principal of binary Distillation

2. linde signal & double column system

PART -V

3. Types of cryogenic insulation: foam, fibre, powder vacuum

1. Liquid cryogen storage vessels and cryogen transfer line;

PART -VI

2. Measurement of temperature: gas and vapour pressure Thermometers, thermocouple, RTD and semiconductor sensors;

PART -VII

3. Safety in cryogenic systems fir, asphyxiation, cold burns and pressure problems

Books

1. Randall F. Barron, Cryogenic Systems, McGraw-Hill.

2. Marshall Sitting and Stephen Kidd D, Cryogenic Research amd Applications, Van Norstad

3. Russell Burton, Scott Cryogenic engineering, Van Nostrand,

DE/ME-1.3 NON-CONVENTIONAL ENERGY RESOURCES

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Renewable and non-renewable energy sources, their availability and growth in India; energy consumption as a measure of Nation's development; strategy for meeting the future energy requirements.

2. Solar Energy:

Solar radiation - beam and diffuse radiation; earth sun angles, attenuation and measurement of solar radiation; Optical properties of materials and selective surfaces; Principles, general description and design procedures of flat Platte and concentrating collectors; Performance analysis of cylindrical and parabolic collectors; Solar energy storage systems - their types, characteristics and capacity; solar ponds. Applications of solar energy in water, space and process heating, solar refrigeration and air conditioning; water desalination and water pumping; solar thermal power generation; solar cells and batteries; economic analysis of solar systems.

3. Wind Energy:

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of accodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

4. Direct energy conversion systems:

i) Magnetic Hydrodynamic (MHD) Generator: gas conductivity and MHD equations; operating principle, types and working of different MHD systems – their relative merits; MHD materials and production of magnetic fields.

ii) Thermo-electric generators: Thermo-electric effects and materials; thermo-electric devices and types of thermo-electric generators; thermo-electric refrigeration.

iii) Thermionic generators: thermoionic emission and materials; working principle of thermionic convertors.

iv) Fuel Cells: thermodynamic aspects; types, components and working of fuel cells.

v) Performance, applications and economic aspects of above mentioned direct energy conversions systems.

5. Miscellaneous Non-Conventional energy Systems:

i) Bio-mass: Concept of bio-mass conversion, photo-synthesis and bio-gasification;

Bio gas generators and plants - their types constructional features and functioning; digesters and their design; Fuel properties of bio gas and community bio gas plants

ii) Geothermal: Sources of geothermal energy - types, constructional features and associated prime movers.

iii) Tidal and wave energy: Basic principles and components of tidal and wave energy plants; single basin and double basin tidal power plants; conversion devices Advantages/disadvantages and applications of above mentioned energy systems.

Books

1. H.P. Garg and Jai Prakash, Solar Energy : Fundamentals and Applications, Tata McGraw Hill.

2. S.P. Sukhatme, Solar Energy: Principles of Thermal Collection and Storage, Tata McGraw Hill.

3. John A. Duffic and W. A. Beckman, Solar Engineering of Thermal Processes, John Wiley.

4. S. L. Sheldon, Chang, Energy Conversion, Prentice Hall.

5. O. M. Bockris and S. Srinivasan, Fuel Cells, McGraw Hill.

DE/ME-1.4 ENERGY CONSERVATION AND MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

Need for energy conservation, its potentials, fiscal incentives, primary energy sources such as coal, gas, oil, nuclear fuel, Optimum use of prime movers for power generation such as steam turbines, gas turbines, diesel and gas engines, energy intensive industries i.e. iron and steel, aluminum, pulp and paper, textile and oil refineries and their energy usage pattern.

Plant Good house keeping measures in air conditioning boilers, combustion system, steam, furnaces and general awareness, Energy audit, methodology and analysis, Energy conservation case studies in air conditioning, boiler and burners

Waste heat recovery systems i.e. recuperates economizers waste heat boilers, heat pipe heat exchangers regenerators etc. energy storage systems thermal storage, insulation, refractory, specialized processes such as Dielectric & micro wave heating, electronic beam welding, Fluidized bed technology, laser as a welding tool, Alternative sources of energy.

Books

1. D.A. Reay, Industrial Energy Conservation Handbook, Oxford Press.
2. P. L. Diwakar Rao, Energy Conservation Handbook, Utility Publication Ltd.
3. Richard Greene, Process Energy conservation (Chemical Engineering), McGraw-Hill.

DE/ME-1.5 FLUID MECHANICS-II

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Potential Flow:

Stream function and velocity potential functions for standard flow patterns uniforms flow, source/sink, doublet and free vortex ; combination of uniform flow with certain flows to obtain flow patterns of various shapes such as flow past a half body, a cylinder, a Rankine oval body, and a cylinder with circulation : Kutta joukowski, Theorem-lift on a cylinder.

2. Viscous Flow:

Navier Stokes equation of motion; Relationship between shear stress and pressure gradient; two dimensional laminar flow between two fixed parallel planes ; Plain Couette flow and its application to hydro-dynamic theory of lubrication.

3. Turbulence:

Fluctuation velocity components; intensity and scale of turbulence; Reynolds equations and turbulence modeling.

4. Boundary Layer:

Salient features of flow pattern in a boundary layer; Velocity and shear stress distribution along the boundary; Von-Karman momentum integral equation, Quantitative correlation for boundary layer thickness, local skin friction coefficient and drag coefficient in laminar, turbulent and laminar turbulent combined boundary layer flows on a flat plate without pressure gradient; flow over a courved surface boundary layer separation and its control.

5. Flow Around Immersed Bodies:

Concept of friction, pressure, wave and induced drag- lift and drag coefficients; variation of drag coefficient with Reynolds number for two dimensional bodies (flat plate, circular cylinder) ; Vortex shedding from cylindrical bodies; effect of streamlining ; drag coefficient versus Reynolds number for flow past axisymmetric bodies (sphere) ; Terminal velocity ; Lift of an airfoil ; Airfoil of finite length-effect on drag and lift ; Downwash and induced drag.

6. Compressible Flow:

Wave propagation and sonic velocity; Mach number, Limits of incompressibility and compressible flow regimes; pressure field due to a moving source of disturbance, Mach cone and Mach angle. Basic equations for one-dimensional compressible flow; static and stagnation values; Isentropic flow relations; compressibility correction factor. Isentropic flow through a duct of varying cross-section, mass flow rate and choking in a converging passage. Normal shock and change in flow properties across a normal shock wave.

Books

1. B.S. Massey, ELBS and Van Nostrand, Mechanics of Fluids, Reinhold Co.

2. Richard H.F. Pao, Fluid Mechanics, John Wiley.

3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria.

4. J.F. Douglas, J.M. Gasionckw, and J.A. Swaffield JP, Fluid Mechanics , Pitman.

5. V.L. Streeter and E.B. Wylie, Fluid Mechanics, McGraw Hill.

DE/ME-1.6 SOLAR ENERGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Solar Flux and Weather Data:

Introduction, Solar Constant, Spectrum of sun, Diurnal Variation of Direct Sunlight, Height variation of direct sunlight. Standard Atmosphere, Zenith Distance Flux Variation, Geographical distribution of sun-shine and effects of weather on Solar Flux. Introduction to solar Flux observation, Instruments such as pyranometer, Phyrheliometer and Sunshine Recorder, Correlation between direct and total Insulation, Solar flux variation dynamic, Correlation of sunshine with Wind Velocity, Environmental Thermal Infrared Flux and ETIR Model.

2. Solar Availability:

Introduction, Zenith Distance Vs time, Time of sunrise and sun-set fully Tracking collector, Variation of flux curves with latitude and geometry, Introduction tom Fixed Flat plate (horizontal, latitude Tilted, fixed latitude + 15°, Vertical South-facing, seasonally Tilted) N-S and horz, east west tracking and N-S polar east west tracking, East west horz and N-S tracking, Comparison of theoretical curves with observation, comparison of daily output; Peak flux Vs Average flux.

3. Heat Transfer in Solar Collectors:

Introduction, Heat Losses in a Distributed Collector system. The Liquid Transfer Module System, Solar Heat Availability, Fluid Mechanics, Fluid Properties, Temperature Rise, Solar Flux, Pressure Drop Relations, Reynolds Number, Ratio of Power Expended to Power Generated, Magnitude of Power Output/Input Ratio, Parametric Relationships for Fluid Transfer, Variation of Output/Input Ratio with Solar Flux. Air-Transfer Systems, Air Heat Transfer in Terms of Volume Rate of Flow, Typical Evaluation Situation. Alternative Forms of the Heat-Rise Equation, Effect of Changing Heat-Transfer Fluid, Heat Transfer in Evacuated Collectors, Thermodynamic Utilization of Collected Energy, Evacuated Collectot Trade offs. Linear Absorber with Air Radiation Suppression Using Honeycombs Convection Suppression Using Honey-combs, Heat Pipes, Heat Transfer alongh Thin Sheets, Differential Thermal Expansion, Problems.

4. Flat-Plate Collectors:

Introduction, Basic Collector Configurations, Diurnal Temperature, Profile, Thermal Inertia U-Factor, Collector Heat Balances. Sample Calculation, Surface Temperature. Efficiency versus-Temperature Curves, General Properties of an efficiency Vs Change and Temperature, The Bare Collector; Single –Window Collector, Double Window Collector Improvement of Performance, Geometrical Suppression of Convection, Window Temperature. Effect of Selective Absorber Surface, Selective Windows Facing Selective Surface Combination of Absorber and selective windows, Comparison of Thermal Behaviour for Selective Windows, Window Absorption Non reflection Coated Window, Variation of Efficiency with Solar Flux, Evacuated, Cooling, Selective Radioactive Cooling, Cylindrical Collector Structure Flat-Plate .Collector performance, Solar Ponds, Problems

5. Energy Storage:

Introduction, Basic System Diagram, Peaking Effect of Back up Demands, Energy Storage, Hydrostorage Chemical Batteries Flywheels Chemical Storage, Compressed Air, Biological Storage, Thermal Storage, Sensible-Heat Storage, Latent-Heat Storage, Salt Eutectics, Zoned Thermal Storage Fluid Tank, Rock Thermal Storage Tank, Thermal Storage Tank Farm, Heat Management with and without Phase Change, Thermal inertia, Calculation of Detailed Performance, Problems. Application of Solar Energy (History and Survey Application) Community Heating & Cooling system, Solar Water pumping, Solar gas absorption refrigeration, MEC Cooling system, Two stage evaporative cooling etc.

6. Direct Conversion to Electricity:

Introduction, Direct conversion by Means of Solar Ce4lls, Silicon Cells, Manufacture of Silicon Cells, Efg Ribbon Silicon Cells Polycry Stalline silicon cells, Cadmium sulfide Solar Cells, Manufacture of Cadmium Sulfide Cells Gallium Arsenide Solar Cells, Thermal Behaviors of Solar Cells Cooled Solar Cells for Concentrating System. Thermo-electric Solar Cells, Thermonic Solar Cells, Phase-Change Thermal Direct Conversion, Problems.

Books

1. Aden B.Meinel and Marjoric P.Meinel, An Introduction to Applied Solar Energy, Addison Wesley.

2. Jan F.Kreider and Fran Kreith, Hand Book of Solar Energy, McGraw-Hill.

DE/ME-1.7 Heat Exchanger Design

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Classification, types and applications of heat Exchangers, Heat Exchanger Design methodology, Selection of Heat Exchangers.

2. Single Phase Heat Exchangers:

LMTD and NTU methods, Rating and sizing methods, design criteria, geometry, process parameters, pressure drops and applications.

3. Two Phase Heat Exchangers:

Types of Boiling, Boiling mechanisms, two phase flow boiling pressure drop Condensation Mechanism, types of condensers and design procedures, Evaporators, Reboilers, Multiple effect evaporators, Design procedures, Liquid chillers, kettle, thermosyphen and forced circulation Reboilers, Augmented surface heat Exchangers, Heat transfer coefficients, pressure drops, compact heat exchangers and air coolers, plate heat exchangers and plate fine heat exchangers.

4. Heat Pipe Heat Exchangers:

Types and design procedure and applications Installation, Operation and Maintenance: Fouling factors, type of fouling and cleaning methods.

5. Mechanical Considerations:

Codes and Standards, Mechanical design requirements and materials.

Books

1. Saunders EAD, Heat Exchangers Selection Design and Construction, Longman Scientific and Technical, John Wiley.

2. D.Q. Kern, Process Heat Transfer International Edition, Mc. Graw Hill.

3. J.P. Holman, Heat Transfer, Mc. Graw Hill.

4. J.P Gupta, Fundamentals of Heat Exchangers and Pressure Vessels Technology, Hemisphere Publishing Corporation.

DE/ME-1.8 POWER PLANT ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Energy sources for generation of electric power, Principles types of power plants-their special features and applications, Present status and future trends.

2. Hydro-Electric Power Plants:

Classifications, Components and their general layout, Hydroelectric survey, rainfall run-off, hydrograph, flow duration curve, mass curve, storage capacity, Site selection.

3. Steam Power Plant:

General Introduction, Developing trends, Essential features, Site

Selection, Coal-its storage, preparation, handling, feeding and burning, Ash handling,

dust collection, High pressure boilers.

4. Diesel and Gas Turbine Power Plants:

Field of use, components, Plant layout, Comparison with stream power plants, Operation of combined steam and gas power plants.

5. Nuclear Power Plant:

Nuclear fuels, nuclear energy, Main components of nuclear power plant, Nuclear reactors-types and applications, Radiation shielding, Radioactive waste disposal, Safety aspects.

6. Power Plant Economics:

Load curves, terms and conditions, Effect of load on power plant design, methods to meet variable load, prediction of load, cost of electric energy, Selection of types of generation and generating equipment, Performance and operating characteristics of power plants, Load division among generators and prime movers, Tariff methods of electric energy. Non-Conventional Power Generation: Geothermal power plants, Tidal power plants, Wind power plants, Solar power plants, Electricity from city refuge.

7. Direct Energy Conversion Systems:

Thermoelectric conversion system, Thermionic conversion system, Photo voltaic power system, Fuel Cells, Magneto-hydrodynamic system.

Books

1. P.K.Nag, Plant Engineering, Tata McGraw Hill.

2. G.R. Nagpal, Power Plant Engineering, Khanna Publishers.

3. S.C. Arora and S. Domkundwar, Power Plant Engineering, Dhanpat Rai.

DE/ME-1.9 GAS DYNAMICS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Basic concepts of Gas Dynamics and Gas Properties:

Definition: Units and dimensions. The concepts of continuous, properties of the continuum. Methods of describing fluid motion, Lagrangian method. Eulerian Method. The integral form of the equations of Conservations of Mass. Momentum and energy as applied to Control Volumes, applications to the study flow of inviscid compressible fluids.

2. Fundamentals Equations Study of One Dimensional Flow:

Continuity equation, the momentum equation, the dynamic equation and Euller's equation. Bernoulli's equation, thrust function, steady flow energy equation.

3. Isentropic Flow:

Introduction, Acoustic velocity, Mach number, Mach line and Mach angle. Classification of flows, Karman's rules supersonic flow, flow parameters, Critical conditions stagnation values.

4. Flow in Ducts with Heating or Cooling:

Stagnation temp. change, governing equations, Rayleigh lines, choking effects in simple to change. Maximum heat transfer.

5. Flow in constant- Area Ducts with friction:

Friction loss, the friction parameter, Fannolines, effect of the increase of inlet Mach number and duct length. Chocking due to friction. Isothermal flow through long ducts.

6. Normal Shock Waves:

Formation of shock waves, weak waves, compression waves. Governing relations of the Normal shock, Pressure. Temperature, Density, Mach number across shock.

7. Oblique shocks: Oblique shock equations, shock geometry, shock polars.

8. Flow through Nozzles:

The Converging diverging nozzle, area ratio for complete expansion, effect of varying back pressure on nozzle flow. Under-expansion and over-expansion in nozzle flow. Losses in nozzle.

9. Flow through Diffusers:

Classification of diffusers, internal compression subsonic diffuser, velocity gradient, effect of friction and area change, the conical internal-compression subsonic diffuser, external compression subsonic diffuser, supersonic diffuser, normal shock supersonic diffuser, the converging diverging supersonic diffuser.

10. Introduction to Multidimensional Flow:

The equation of continuity, the momentum equations, Bernoulli,s equation, the energy equation, Navier-Stock' Equations, Potential Flow.

Books

1 Asher H. Shaprio, Thermodynamics of Compressible Fluid flow, John Wiley.

2. Culbert B. Laney, Computational Gas Dynamics, Cambridge University Press.

Group-II

DE/PE-2.0 Non Traditional Machining Processes

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Latest trends in Manufacturing, Introduction to Flexible manufacturing system, Introduction to computer integrated manufacturing, Limitations of conventional machining processes, Development of Non conventional machining processes, their classification, advantages and major applications

2. Advanced Mechanical Processes:

Ultrasonic machining, Water Jet Machining and Abrasive Flow Machining-elements of process, Applications and limitations

3. Electrochemical & Chemical Removal Processes:

Principle of operation, elements and applications of Electrochemical Machining, Electrochemical grinding, Electrochemical deburring, Electrochemical honing, Chemical Machining, Photochemical machining

5. Thermal Metal Removal Processes:

Electric Discharge Machining- Mechanism of metal removal, electrode feed control, die electric fluids flushing, selection of electrode material, applications. Plasma Arc Machining- Mechanism of metal removal, PAM parameters, Equipment's for unit, safety precautions and applications. Laser Beam machining- Material removal, limitations and advantages. Hot machining- method of heat, Applications and limitations. Electon-Beam Machining-, Generation and control of electron beam, process capabilities and limitations

6. Hybrid Machining Processes:

Concept, classification, application, Advantages

Books:

1. P.C. Panday and H.S. Shan, Modern Machining Processes, Tata Mc Graw Hill

2. G. Boothroyd and W.A. Knight, Fundamentals of Machining and Machine Tools, Marcel Dekker Inc.

3. G.F. Benedict, Non-traditional Manufacturing Processes, Marcel Dekker Inc.

4. V.K Jain, Advanced Machining Processes, Allied Publishers

5. Hassan Abdel, Gawad El-hofy Fundamentals of Machining Processes: Conventional and Nonconventional Processes, Taylor & Francis

DE/PE-2.1 INDUSTRIAL ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Definition and scope of industrial engineering Role of an industrial engineering Role of an industrial engineer in industry, Functions of industrial engineering department and its organization, Qualities of an industrial engineer.

2. Plant Layout and Material Handling:

Different types of layouts viz. Product, process and combination layouts, Introduction to layouts based on the GT, JIT and cellular manufacturing systems, Development of plant layout. Types of material handling equipment, relationship of material handling with plant layouts.

3. Work-study:

Areas of application of work study in industry; Method study and work measurements and their inter-relationship. Reaction of management and labour to work study; Role of work study in improving plant productivity and safety.

4. Method Study:

Objectives and procedure for methods analysis: Select, Record, Examine, Develop, Define, Install and Maintain. Recording techniques, Micromotion and macro-motion study: Principles of motion economy, Normal work areas and work place design.

5. Work Measurement:

Objectives, Work measurement techniques - time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, standard time.

6. Value Engineering:

Types of values, concept of value engineering, phases of value engineering studies, application of value engineering.

7. Work Design:

Concepts of job enlargement, job enrichment and job rotation. Effective job design considering technological and behavior factors.

8. Ergonomics:

Introduction to ergonomic considerations in designing man-machine systems with special reference to design of displays and controls.

Books

1. Gayler Shotbolt, Introduction to Work study, Tata McGraw Hill.

2. H.S. Shan, Work Study and Ergonomics, Dhanpat Rai and Co. (p) Ltd.

3. R. Bernes, Motion and time study by, John-Wiley.

4. D.J. Oborne, Ergonomics at work, John Wiley.

5. D. Miles, Techniques of Value Analysis and Engineering, McGraw Hill.

DE/PE-2.2 MODELING AND SIMULATION

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Modeling

Need for system modeling, systems approach to modeling, open and feed back systems, combination of simple feed back systems, feed back time lag effects, feed back and managerial systems

2. Production and Operations Management

Principle of analytical modeling, kinds of analytical methods, measures of effectiveness, cost analysis large systems

3. Simulation

Monte Carlo simulation, generation of stochastic variates, continuous and discrete probability distributions, application of Monte Carlo methods for production systems, computer simulation models, Macro Dynamic models, examples from business and industry, design of management game, Simulation languages SIMULA, SIMSCRIPT, GPSS etc. Statistical output analysis.

4. Analog computer simulation;

Basic analog computer components and operations; amplitude and time scaling; solution of linear and non-linear partial differential equations, formulation of model for a dynamic system and its simulation on analog computer.

Books

1. Narsingh Deo, System Simulation with Digital Computer, PHI Learning.

2 G. Gordon, System Simulation, PHI Learning.

3. Jackson A.S, Analog Computation, McGraw-Hill.

4. Naylor T.H. et. al, Computer Simulation Techniques, John Wiley.

5. S. Buffa, Modern Production Management, John Wiley .

DE/ME-2.3 OPERATIONS MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Need and Scope of Operation Management:

Types of production system and their characteristics, productivity definition, types and measurements

2. Product Design And Development:

Steps involved in product design and development, considerations of technical, ergonomic, aesthetic, economic and time factors. Use of concurrent engineering in product design and development. Discussion of case studies. Feasibility and locational analysis.

3. Planning And Forecasting:

Role of market survey and market research in pre-planning, long medium and short range forecasting, objective and techniques of forecasting, smoothening and revision of forecast

4. Production Planning:

Production planning objective and functions, Bill of material, Capacity and man power requirement planning, operation analysis and process planning, long range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques of aggregate planning, master production scheduling, MRP and MRPII Systems

5. Production Control:

Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems.

6. Material Management:

Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. Methods of physical stock control.

7. Quality Control:

Meaning of quality and quality control, quality of design, quality of conformance and quality of performance, functions of quality control. Introduction to statistical quality control-control charts and sampling plans.

8. Management Information Systems:

Introduction to MIS, Steps in designing MIS, Role of Computers in MIS.

9. Maintenance Systems:

Type of maintenance, objective of maintenance, Planned maintenance strategies, preventive maintenance, condition monitoring and total productive maintenance

BOOKS:

1. S.N. Charry, Production and Operation Management, Tata-McGraw Hill.

2. J.G. Monks, Production/Operation Management, Tata-McGraw Hill.

3. R.N. Nauhria and Rajnish Prakash, Management of systems, Wheeler Publishing.

4. Elwood S. Buffa, Modern Production Management, John Wiley.

5. E. L. Grant and R.S. Leaven Worth, Statistical Quality Control, McGraw Hill.

DE/ME-2.4 NON-DESTRUCTIVE TESTING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Classification of techniques of material testing, Need and Significance of Non Destructive Testing methods, type of Non Destructive testing methods.

2. Radiographic Examination:

Radiant energy and radiography, practical applications, X-ray and Gamma –ray equipment, effect of variables on radiographs, requirement of a good radiograph, interpretation of radiograph, safety precautions, Xeroradiography.

3. Magnaflux methods:

Basic principles, scope and applications, magnetic analysis of steel bars and tubing magnetization methods, equipment, inspection medium, preparation of surfaces Fluorescent Penetration inspection, Demagnetization.

4. Electrical and ultrasonic Methods:

Basic principles, flaw detection in rails and tubes (Sperry Detector), Ultrasonic testing surface roughness, moisture in wood, Detection of defects in ferrous and non ferrous metals, plastics, ceramics, measurement of thickness, hardness, stiffness, sonic material analyzer, proof tests, concrete test hammer.

5. Photoelasticity:

Concept and applications of Plane and circular polarization, Photo stress, models.

Books

1. H.E. Davies, G.E Troxell and GFW Hauck, The testing of Engg materials, Mc Graw Hill.

2. W.H Armstrong, Mechanical Inspection, Mc Graw Hill.

DE/ME-2.5 TOTAL QUALITY MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Quality and Total Quality Management:

Excellence in manufacturing/service, factors of excellence, relevance of TQM.

2. Concept and definition of quality:

Total quality control (TQC) and Total Quality Management (TQM), salient features of TQC and TQM. Total Quality Management Models, benefits of TQM.

3. Just-in-time (JIT):

Definition: Elements, benefits, equipment layout for JIT system, Kanban system MRP (Material Requirement planning) vs JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

4. Customer:

Satisfaction, data collection and complaint, redressal mechanism.

5. Planning Process:

Policy development and implementation; plan formulation and implementation.

5.Process Management:

Factors affecting process management, Quality function development (QFD), and quality assurance system.

7. Total Employees Involvement (TEI):

Empowering employees: team building; quality circles; reward and Recognition; education and training, Suggestion schemes.

8. Problems solving:

Defining problem, Problem identification and solving process, QC tools.

9. Benchmarking:

Definition, concept, process and types of benchmarking.

10. Quality Systems:

Concept of quality system standards: relevance and origin of ISO 9000; Benefits; Elements of ISO 9001, ISO 9002, ISO 9003.

11. Advanced techniques of TQM:

Design of experiments: failure mode effect analysis: Taguchi methods.

BOOKS:

1. Sunder Raju, Total Quality Management , Tata McGraw Hill.

2. M.Zairi, TQM for engineers, Aditya Books.

3. J.L. Hradeskym, Total Quality Management Handbook, McGraw Hill.

4. Dalela and Saurabh, ISO 9000 quality System, Standard Publishers.

DE/ME-2.6 MAINTENANCE AND RELIABILITY ENGINEERING

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Objective and characteristics of maintenance function, Organization of the maintenance system, Operating practices in maintenance, Maintenance record keeping.

2. Cost Aspect of Maintenance:

Costs of machine breakdown, estimation of life cycle costs, Application of work measurement in maintenance, Manpower planning and training, Incentive payments for maintenance.

3. Planning of Maintenance Activities:

Evaluation of alternative maintenance policies breakdown, preventive and predictive maintenance, fault diagnosis and condition monitoring techniques, simulation of alternative practices, Development of preventive maintenance schedule, House keeping practices, total productive maintenance.

4. Maintenance Engineering:

Maintenance requirements of mechanical, electrical, process and service equipment, Safety aspect in maintenance, Aspect of lubrication; chemical control of corrosion, Computerized maintenance information systems.

5. Reliability:

Concept and definition, configuration of failure data, various terms used in failure data analysis in mathematical forms, component and system failures, uses of reliability concepts in design and maintenance of different system.

6. Reliability and Availability of Engineering systems:

Quantitative estimation of reliability of parts, Reliability of parallel and series elements, Accuracy and confidence of reliability estimation, Statistical estimation of reliability indices, Machine failure pattern, Breakdown time distribution.

7. Reliability improvement:

Reliability in design, reliability in engineering, systems, systems with spares, reliability simulation, redundant and stand by systems, confidence levels, component improvement element, unit and standby redundancy optimization and reliability-cost trade off.

8. Fault Tree Analysis:

Introduction and importance, fault tree construction, reliability calculations from fault tree, tie set and cut set methods, event tree and numerical problems.

Books

1. Lindley R. Higgins, Maintenance Engineering Handbook, McGraw Hill.

2. R.H. Clifton, Principles of Planned Maintenance, Edward Arnold.

3. A Kelly, Maintenance Planning control, McGraw Hill.

4. L.S Srinath, Reliability Engineering, East West Press.

5. S.K. Sinha, Reliability Engineering, John Wiley.

DE/ME-2.7 MATERIAL MANAGEMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Meaning, definition, functions of materials management, Concept of integrated material management, Relationship of material management with other Organizational functions.

2. Material Planning & Budgeting:

Need for material planning, Factors affecting material planning, Techniques of material planning, Material classification, codification and standardization, Material budgeting - meaning and need, techniques of material budgeting.

3. Inventory Control:

Need and meaning of inventory, types of inventory, functions of inventory control, Inventory costs, Inventory control tool - ABC, VED, XYZ and FSN: Economic order Quantity and replenishment of stocks. Physical control of inventory: Fixed order, Two bin and Kardex systems - Material requirement planning (MRP-I) Spare parts control for maintenance purposes. Evaluation of inventory control performance. Concept of Just-in-Time(JIT). Use of computers for inventory control

4. Purchasing:

Purchasing principles, procedures and systems, Functions of purchasing, Make-or-buy decision, Vendor development and vendor rating. Factors affecting purchase decisions, Legal aspects of purchasing, Documentation and procedure for import.

5.Storage:

Functions and importance of store keeping, types of stores, store accounting and store verification, Legal aspects of store keeping, Management of surplus, scrap and obsolete items. Importance of material handling in store keeping, handling equipment.

Books

1. M.M. Verma, Materials Management, S. Chand and Co.

2. Gopal Krishnan and Sundaresan, Material Management - An Integrated Approach, Prentice Hall

3. Dobbler and Burt, Purchasing and materials management, Tata McGraw Hill

4. M. Starr and D. Miller, Inventory control, Prentice Hall.

DE/ME-2.8 MANAGEMENT INFORMATION SYSTEM

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Information and Decision Making:

Concept of information; data versus information, characteristics of information, classification of information, cost and value of information, Use of information in the decision making process, information requirements for decision making, types of decisions, decision making process, decision making models role of information system, decision support systems, expert systems.

2. Management Information Systems (MIS):

Concept, Characteristics and importance of management information systems, types of information systems role of computers in management information systems, hierarchy of data processing systems, operating elements of MIS, information needs of MIS, storage and retrieval of data processing, functions of information systems, management reports. Analysis and design cycle for MIS. Various approaches to system analysis and design. Strategic and project Planning for MIS, analysis and design, matching mission, objectives and plans of MIS with business plans, project planning for MIS, Conceptual system design, Detailed system design, Implementation, Evaluation and Maintenance of MIS.

3. Computer Networks and Data Communication Computer network:

Local Area networks; characteristics topologies network structures, switching networks, OSI standards for multi vendor network. I.A.N standards, application of networks, Data Communication concepts, types and modes of transmission, hardware requirements, communication controllers, Data Communication software, data communication protocol.

4. Data Base Management Systems:

Introduction, data base designing, relational data base management system. Introduction to computerized data base management system.

Books

1. Robert G. Mudrick, Joel E. Ross and James R. Clagget, Information System for Modern Management, Prentice Hall.

2. G. Davis and M. Olson, Management Information systems, McGraw Hill

3. Henry C. Lucas, Information systems for management, McGraw Hill.

DE/ME-2.9 ENTREPRENEURSHIP

Internal Marks: 40 External Marks: 60 Total Marks: 100

1.Concept of Entrepreneurship:

Entrepreneurship and small scale industry, need for promotion of entrepreneurship, entrepreneurship development programmes (EDP), personality characteristics of entrepreneur.

2. Identification of Investment Opportunities:

Governmental regulatory framework, industrial policy, industrial development and regulation act, regulation of foreign collaboration and investment, foreign exchange regulation act, incentives for export oriented units, incentives for units in industrially backward areas, incentives for small scale industry, government assistance to SSI, how to start and SSI, list of items reserved for SSI, Scouting for project ideas, preliminary screening, project identification for an existing company.

3. Market and Demand Analysis:

Information required for market and demand analysis, market survey, demand forecasting, uncertainties demand forecasting.

4. Cost of Project and Means of Financing:

Cost of project, means of financing, planning the capital structure of a new company, term loan financial institutions, cost of production.

5. Financial Management:

Concept and definition of financial management types of capital, of finance, reserve and surplus, concepts and liabilities, profit and loss statement balance sheet, depreciation, methods of calculating depreciation break even analysis.

Books:

1. E.D.I. Ahmedabad, Publication regarding Entrepreneurship.

2. Prasanna Chandra, Project Preparation, Appraisal Budgeting and Implementation, McGraw Hill. .

4. C.S.Gupta and N.P.Srinivasan, Entrepreneurial Development, S. Chand and co.

5. S. S. Khanka, Entrepreneurship Development Practice and Planning, S. Chand and co.

Group-III

DE/PE-3.0 PRODUCT DESIGN AND DEVLOPMENT

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Visual Design:

Basic elements and concept of visual design-line color, Balance proportion, Size shape mass, unity and variety, Special relationships and composition in two and three dimensions.

2. Form and Color:

Elementary forms their characteristics and significance in design. Form transition, Form in relation to ergonomics, material and manufacturing process, color as an element of design, color clarification dynamics, interrelation of colors, colors and traditions; Psychological use of color form and material.

3. Product Graphics:

Meaning and objectives of product graphics. Basic principles of graphic design, Visual communication aspects of product graphics, Graphics of displays and control panels,

4. Product Detailing:

Standard fastening and joining details in different materials; Temporary and permanent joints: Detailing for plastic products, Detailing for fabricated products in sheet metal.

5. Products Development:

Definition and objective, Role of designer in product development. Manufacturing and economic aspects of product development, Product promotions, product developments.

BOOKS:

1. W.H. Mayal, Industrial Design for Engineers, London Liifee Books Ltd.

2. Huchingson R. Dale, New Horizons for Human Factors in Design, McGraw Hill.

3. N.L. Svensson, Engineering Design.

4. R. Matousek, Engineering Design.

5. K. J. Mccormick (Ed), Human Factor Engineering, McGraw Hill.

DE/PE-3.1 MACHINE TOOL DESIGN

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

General requirements to machine tools, Machine tool design recommendations, Classification of motions to shape surface, Machine tool drives for rectilinear motion, Periodic motion, reversing motion etc.

2. Kinematics of Machine Tools:

Kinematics or gearing diagram of Lathe, drilling Machine, Milling Machine etc. Main. drive and feed drive, principles specification of Machine tool.

3. Design of Kinematics Scheme:

Methods to determine transmission ratios for drives,. Development of Kinematics scheme, minimum of transmission groups, Determination of number of teeth on gears.

4. Speed and Feed Boxes:

General requirement Design of gear trains, speed boxes types, speed changing devices, Feed boxes characteristics of feed mechanism, types of Rapid traverse mechanisms, variable devices.

5. Spindle Design and Spindle Bearings:

Main requirement, Materials and details of spindle design, Spindle bearings, bearings, types of bearings and their selections, Bearing Materials BED,

6. Columns, Tables and Ways:

Materials, typical constructions and design.

7. Machine Tools Control Systems:

Requirement of control system selection and construction of control systems Mechanical control system, predilection control, remote control safety devices.

8. Machine Tool Dynamics:

Dynamic performance, dynamic and elastic system of Machine, tools. Dynamics of cutting forces, tool chatter.

Books:

1. Sen and Bhattacharya, Machine Tools Design, CBS Publishers.

2. N.K. Mehta, Machine Tool Design, Tata McGraw Hill.

3, N. Acherkan, Machine Tool Design, Four Volumes, Mir Publishers.

5. S.K. Basu and D.K. Pal, Design of machine tools, Oxford and IBH.

DE/PE-3.1 OPTIMIZATION TECHNIQUES

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction : Origin of OR and its role in solving industrial problems : Generalapproach for solving OR problems. Classification of mathematical models: variousdecision making environments.

2. Linear Programming: Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis.

3. Transportation and Assignment Models: Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

4. Dynamic Programming: Introduction to deterministic and probabilistic dynamic programming.

5. Queuing Theory: Types of queuing situation: Queuing models with Poisson's inputand exponential service, their application to simple situations.

6. Replacement Models: Replacement of items that deteriorate, Replacement ofitems whose maintenance and repair costs increase with time, replacement of itemsthat fail suddenly;

replacement of items whose maintenance costs increase with timeand value of money also changes, individual replacement policy, group replacement policy.

7. Network models: Shortest route and traveling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of net works,identification of critical path, slack and float, crashing of network for cost reduction.

8. Non-linear Programming Models: Introduction to non-linear programming models. Problems related to the topic.

BOOKS:

1. H.M Wagner, Principles of Operations Research, Prentice Hall.

2. P.K. Gupta and D.S. Hira, Operations Research, S. Chand & Co.

3. F.S. Hiller and G.I. Libermann, Introduction to Operation Research, Holden Ray.

4. A Management Guide to PERT/CPM Wiest & Levy Prentice Hall

DE/ME-3.3 TOOL DESIGN

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Process Planning:

Product Engineering, Process Engineering, Definition of Process Planning, Contents of Process Plan, Process Operations, Steps of Process Planning, Process Planning Sheet, Planning and Tooling for Low Cost Planning.

2. Jigs and Fixture:

Principles of jig and fixture design, Principle of degrees of freedoms, methods of locations and clamping, Various devices for location and clamping, indexing devices, Hydraulic and pneumatic actuation of clamping devices, jig bushes, use of standard parts of jig design, type of drilling jigs, milling fixtures, lathe fixture, grinding fixtures and their classification.

3. Die Design:

Components of die design, design of die blocks, punches and strippers, methods of holding punches, sketches of stock stops, Design procedure for progressive dies, compound dies and combination dies for press tool operation forging die design for drop and machine forging parts.

4. Tool Layout for Turrets:

Characteristics of Turret lathes, Differences between capstan and turret lathes, methods of holding jobs on the Turret lathe, Universal chucking equipment, universal bar equipment, operation sheet and tool layout.

5. Tool Layout for Automatics:

Classification of Automatics, Turret type automatic, tool layout procedure, time required for each operation, operation sheet, tool layout, cam layout.

6. Tooling Costs:

Estimating cost of a product, estimating costs of tools, Economics of tooling, Break even point analysis, minimum cost analysis.

7. Gauges:

Limits and fits, Plain Gauges, types of Gauges, fundamentals of Gauge Design, Gauge makers tolerance, allowance for wear, Practical application of Taylor's principles of limit gauging, care of Gauges, Limitation of Limit Gauging.

8. Surface Finish:

Elements of surface finish, Factors affecting surface finish, Effect of surface quality on Functional properties of machine parts, Evaluation of surface finish, Indian Standards on surface finish. Measurement of surface finish, Relationship of surface finish to the production methods. Finishing operations like honing, lapping, buffing super finishing etc.

Books:

1. Cole: Tool Design.

2. C. Donaldson, Tool Design, Mc Graw Hill

3. ASTM, Fundamentals of Tool Design.

4. P.C.Sharma, A Textbook of Production Engineering, S.Chand Publication.

DE/ME-3.4 FINITE ELEMENT METHOD

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

General description of the method summary of the analysis procedure

2. Discretisation of the domain:

Type of elements, location of nodes, number of elements, simplification on offered by physical configuration of body, node numbering scheme.

3. One and Two Dimensional Problems:

Introduction, coordinates and shape functions, Potential energy approach, Galerkin Approach, Assembly of the global stiffness matrix and load vector , FEM equations and treatment of boundary conditions, quadratic shape functions, Two dimensional problems using constant strain triangles

4. Axisymmetric solids subjected to axisymmetric loadings:

Axisymmetric formulation, FEM using triangular element, problem using boundary conditions.

5. Static analysis:

Plain and three Dimensional Trusses, Assembly of global matrix for the banded and skyline solutions, Beams and frames in various different conditions.

6. Dynamic Analysis:

Dynamic equation of motion, consistent mass matrix for truss element frame element and triangular plate element, evaluation of eigen values and eigen vectors.

7. Solution of finite element equations:

Direct integration methods, central difference method, Houbolt method, Wilson method, Newmark method, mode superposition method,

Books:

1. Bathe, Finite Element Procedures in Engineering Analysis, Prentice Hall.

2. Chandrupatla and Belegundu, Introduction to Finite Element in Engineering, Prentice Hall.

3. Cook, Concepts and Applications of Finite Element Analysis, John wiley.

DE/ME-3.5 EXPERIMENTAL STRESS ANALYSIS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Basic Elasticity:

Laws of stress transformation, principal stresses and principal planes, Cauchy's stress quadric strain analysis, strain equations of transformation, Cauchy's strain quadric, stress, strain relationship.

2. Two Dimensional Photoelasticity:

Stress optics law, Optics of polarisation plane and circular polariscope, dark and light field arrangements, fringe multiplication, fringe sharp ending, compensation techniques, commonly employed photo elastic materials.

3. Dimensional Photoelasticity:

Neuman's strain optic relationship, stress freezing in model materials for three dimensional photoelasticity, shear difference method for stress separation.

4. Birefringence Coatings:

Sensitivity, reinforcing effects, thickness of birefringence coatings.

5. Electric Resistance Strain Gauges:

Gauge construction and installation, temperature compensation, gauge sensitivities, gauge factor, corrections for transverse strain effects, factors affective gauge relation, rosetters Rosetre analysis, potentiometer and whetstone's bridge circuits for strain measurements.

6. Brittle Coatings:

Introduction, coating stresses and failure theories, different types of crack patterns, crack detection composition of brittle coatings, coating cure, influence of atmospheric conditions, effects of biaxial stress field.

Books:

1. Dally and Rilley, Experimental Stress Analysis, McGraw Hill.

2. Dow and Adams, Experimental Stress Analysis and Motion Measurement, Prentice Hall.

3. Durelly and Riley, Introduction to Photo Mechanics, Prentice Hall.

DE/ME-3.6 INDUSTRIAL TRIBOLOGY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction:

Tribological considerations, Nature of surfaces and their contact, Physic mechanical properties of surface layer Geometrical properties of surfaces, methods of studying surfaces, Study of contract of smoothly and rough surfaces.

2. Friction and Wear:

Role of friction and laws of static friction, causes of friction , adhesion theory, Laws of rolling friction, Friction of metals and non-metals; Friction measurements. Definition of wear, mechanism of wear, friction affecting wear, wear measurement, Wear of metals and non-metals.

3. Lubrication and Lubricants:

Introduction, dry friction, Boundary lubrication, classic hydrodynamics, hydrostatic and elasto hydrodynamic lubrication, Functions of lubricants, Types of lubricants and their industrial uses, properties of liquid and grease lubricants; lubricant additives , general properties and selection.

4. Special Topics:

Selection of bearing and lubricant, bearing maintenance, diagnostic maintenance of tribological components, lubrication systems, Filters and filtration.

Books:

1. O'Conner and Royle, Standard Hand Book of Lubrication Engg., McGraw Hill.

2. Halling and Wykeham, Introduction to Tribology, Publications Ltd.

3. Raymono O.Gunther, Lubrication, Bailey Bros and Swinfan Ltd.

4. PT Barwll, Rearing Systems, Principles and Practice,Oxford press.

5. A Cameron, Basic Lubrication Theory, Wiley (Indian Edition).

DE/ME-3.7 THEORY OF PLASTICITY

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to Plasticity:

Idealized stress-strain systems, approximate equation for stress strain curves (Ramberg-Osgood, Ludwig's and Karunes equations), Bauschinger effect-yield locus, yield surface.

2. Yield Criteria and Flow Rules:

Tresca theory & Von-Mises yield criterion, their geometrical representation, experimental evidence for the criteria.

3. Slip Line Field Theory:

Two-dimensional plasticity, slip lines, basic equations, Hencjy's first theorem, Geiringer's Velocity equation, Applications of slip line field theory to plane strain problems.

4. Load Bounding:

The lower bound theorem, the upper bound theorem and their corollaries. Application of load bounding to plane strain problems.

Books

1. Johanson and Miller, Plasticity for mechanical Engineers, Van Nostrand.

2. Calladina, Engg Plasticity, Pergmean Press.

DE/ME-3.8 MECHATRONICS

Internal Marks: 40 External Marks: 60 Total Marks: 100

1. Introduction to Mechatronics:

Definition and approach of Mechatronics, Measurement and Control Systems, Microprocessor based controllers and Mechatronics Approach.

2. Sensors and Transducers:

Performance Terminology, Displacement, velocity, Position, Proximity, force, fluid pressure, liquid level, temperature, light sensors, procedure for selection.

3. Signal Conditioning:

Op Amp, Protection, digital signals, Multiplexes and digital signal processing, pulse modulation

4. Pneumatic and Hydraulic Systems:

Actuation systems, Directions, pressure and process control valve, Pneumatic and hydraulic systems

5. Electrical Actuation System:

Mechanical Switches, Solid State Switches, Solenoid, DC/AC Motors, Stepper Motors

6. Microprocessor and Its Application:

Architecture of Microprocssor 8085, Instruction set, Embedding a microprocessor into a Mechatronics system.

7. Microprocessor Based Project:

Assemble a suitable system using microprocessor kit for its control.

Books:

1. W. Bolton, Mechatronics, Pearson Education.

2. Rafiquzzaman, Microprocessors.

3. S. Boennett, Real time computer controls, Prentice Hall.

4. Benjamin C. Kuo, Automatic Control Systems, Prentice Hall.

PUNJAB TECHNICAL UNIVERSITY KAPURTHALA

Scheme and Syllabus
of
B. Tech. Civil Engineering (CE)

Batch 2011

By

Board of Studies Civil Engineering

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Third Semester **Contact Hours: 33 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTAM-301	Engineering Mathematics-III*	4	1	-	40	60	100	5
BTCE-301	Fluid Mechanics-I	3	1	-	40	60	100	4
BTCE-302	Rock Mechanics & Engg .Geology	3	1	-	40	60	100	4
BTCE-303	Strength of Materials	3	2	-	40	60	100	5
BTCE-304	Surveying	3	1	-	40	60	100	4
BTCE-305	Building Materials & Construction	4	0	-	40	60	100	4
BTCE-306	Fluid Mechanics-I Lab	-	-	2	30	20	50	1
BTCE-307	Strength of Materials Lab	-	-	2	30	20	50	1
BTCE-308	Surveying Lab	-	-	3	30	20	50	2
BTCE-309	Workshop Training of 4 weeks duration after 2nd semester Carpentry, Electrical, Plumbing, Masonry, CAD				30	20	50	1
	Total	**20**	**06**	**07**	**360**	**440**	**800**	**31**

*** This subject shall be taught by the faculty of Applied Science Department**

Fourth Semester **Contact Hours: 30 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCE-401	Geomatics Engineering	3	1	-	40	60	100	4
BTCE-402	Construction Machinery & Works Management	3	1	-	40	60	100	4
BTCE-403	Design of Concrete Structures-I	4	1	-	40	60	100	5
BTCE-404	Fluid Mechanics-II	3	1	-	40	60	100	4
BTCE-405	Irrigation Engineering-I	3	1	-	40	60	100	4
BTCE-406	Structural Analysis-I	3	2	-	40	60	100	5
BTCE-407	Concrete Technology Lab	-	-	2	30	20	50	1
BTCE-408	Structural Analysis Lab	-	-	2	30	20	50	1
BTCE-409	General Fitness				100	-	100	
	Total	**19**	**07**	**04**	**400**	**400**	**800**	**28**

Fifth Semester **Contact Hours: 30 Hrs.**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCE-501	Design of Steel Structures-I	4	1	-	40	60	100	5
BTCE-502	Geotechnical Engineering	4	1	-	40	60	100	5
BTCE-503	Structural Analysis-II	3	2	-	40	60	100	5
BTCE-504	Transportation Engineering-I	3	1	-	40	60	100	4
BTCE-505	Environmental Engineering –I	3	1	-	40	60	100	4
BTCE-506	Transportation Engineering Lab	-	-	2	30	20	50	1
BTCE-507	Geotechnical Engineering Lab	-	-	2	30	20	50	1
BTCE-508	Computer Aided Structural Drawing I	-	-	3	30	20	50	2
BTCE-509	Survey Camp of 04 weeks duration after 4th Semester				100	50	150	2
	Total	**17**	**06**	**07**	**390**	**410**	**800**	**29**

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Sixth Semester **Contact Hours: 34 Hrs**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCE-601	Design of Concrete Structures-II	4	1	-	40	60	100	5
BTCE-602	Elements of Earthquake Engineering	3	2	-	40	60	100	5
BTCE-603	Foundation Engineering	4	1	-	40	60	100	5
BTCE-604	Numerical Methods in Civil Engineering	4	1	-	40	60	100	5
BTCE-605	Professional Practice	3	2	-	40	60	100	5
BTCE-606	Environment Engineering –II	3	1	-	40	60	100	4
BTCE-607	Environmental Engineering Lab	-	-	2	30	20	50	1
BTCE-608	Computer Aided Structural Drawing II	-	-	3	30	20	50	2
BTCE-609	General Fitness				100	-	100	
	Total	**21**	**08**	**5**	**400**	**400**	**800**	**32**

Seventh / Eigth Semester

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCE-701	(a) Software Training*	-	-	-	150	100	250	10
	(a) Industrial Training				300	200	500	20``
	Total				**450**	**300**	**750**	30

***List of Software for Training to be learnt during Training Period**
Any software that enhances professional capability in civil engineering practice a partial indicative list is mentioned below:

1. GT STRUDAL
2. PRIMA VERA
3. GEOTECH
4. ARCVIEW GIS
5. GEO 5
6. GEO STUDIO PROF 2004
7. AUTOCAD CIVIL 3D
8. MX ROAD
9. GEOMATIC
10. STAAD PRO
11. HDM-4
12. PLAXIS

13 Any other relevant software

Sreventh / Eigth Semester **Contact Hours: 31 Hrs**

Course Code	Course Name	Load Allocation			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
BTCE-801	Design of Steel Structures-II	4	1	-	40	60	100	5
BTCE-802	Disaster Management	4	0	-	40	60	100	4
BTCE-803	Irrigation Engineering-II	3	1	-	40	60	100	4
BTCE-804	Transportation Engineering-II	3	1	-	40	60	100	4
BTCE-**XXX**	Elective –I *	3	1	-	40	60	100	4
BTCE-**YYY**	Elective –II *	3	1	-	40	60	100	4
BTCE-805	Project	-	-	6	100	50	150	3
General Fitness					100	-	100	
	Total	**20**	**05**	**06**	**440**	**410**	**850**	**28**

* Elective I and Elective II should not be from the same group

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List of Electives:

- **Structural Engineering**

  BTCE- 806 Dynamics of Structures
  BTCE- 807 Finite Element Methods
  BTCE- 808 Advanced Reinforced Concrete Design
  BTCE- 809 Pre-stressed Concrete

- **Geotechnical Engineering**

  BTCE- 810 Ground Improvement Techniques
  BTCE- 811 Soil Dynamics and Machine Foundation
  BTCE- 812 Earth and earth Retaining Structures
  BTCE- 813 Reinforced Earth and Geotextiles.

- **Environmental/ Irrigation Engineering**

  BTCE- 814 Environmental Impact Assesment
  BTCE- 815 Advanced Environmental Engineering
  BTCE- 816 Flood Control and River Engg.
  BTCE- 817 Hydrology and Dams

- **Infrastructure / Transportation Engineering**

  BTCE- 818 Pavement Design
  BTCE- 819 Traffic Engineering
  BTCE- 820 Bridge Engineering
  BTCE- 821 Infrastructure Development and Management

Third Semester

BTAM301 Engineering Mathematics-III

Unit I Fourier Series: Periodic functions, Euler's formula. Even and odd functions, half range expansions, Fourier series of different wave forms.

Unit II Laplace Transforms: Laplace transforms of various standard functions, properties of Laplace transforms, inverse Laplace transforms, transform of derivatives and integrals, Laplace transform of unit step function, impulse function, periodic functions, applications to solution of ordinary linear differential equations with constant coefficients, and simultaneous differential equations.

Unit III Special Functions: Power series solution of differential equations, Frobenius method, Legendre's equation, Legendre polynomial, Bessel's equation, Bessel functions of the first and second kind. Recurrence relations, equations reducible to Bessel's equation.

Unit IV Partial Differential Equations: Formation of partial differential equations, Linear partial differential equations, homogeneous partial differential equations with constant coefficients.

Unit V Applications of PDEs: Wave equation and Heat conduction equation in one dimension. Two dimensional Laplace equation in Cartesian Coordinates, solution by the method of separation of variables.

Unit VI Functions of Complex Variable: Limits, continuity and derivative of the function of complex variable, Analytic function, Cauchy-Riemann equations, conjugate functions, harmonic functions; Conformal Mapping: Definition, standard transformations, translation, rotation, inversion, bilinear. Complex Integration: Line integrals in the complex plane, Cauchy's theorem, Cauchy's integral formula and derivatives of analytic function. Taylor's and Laurent's expansions (without proofs), singular points, poles, residue, Integration of function of complex variables using the method of residues.

<u>Suggested Readings/ Books:</u>

- Kreyszing, E., Advanced Engineering Mathematics, Eighth edition, John Wiley, New Delhi.
- Grewal, B. S., Higher Engineering Mathematics, Khanna Publishers, New Delhi.
- Ian N. Sneedon, Elements of Partial Differential Equations, McGraw- Hill, Singapore, 1957.
- Peter. V. O'Nil, Advanced Engineering Mathematics, Wadsworth Publishing Company.
- Taneja, H. C., Engineering Mathematics, Volume-I & Volume-II, I. K. Publisher.
- Babu Ram, Advance Engineering Mathematics, Pearson Education.
- Bindra, J. S., Applied Mathematics, Volume-III, Kataria Publications.
- Advanced Engineering Mathematics, O'Neil, Cengage Learning.

BTCE301 Fluid Mechanics-I

Fluid and their properties : Concept of fluid, difference between solids, liquids and gases; ideal and real fluids; Continuum concept of fluid: density, specific weight and relative density; viscosity and its dependence on temperature; surface tension and capillarity, vapor pressure and cavitation, compressibility band bulk modulus; Newtonian and non-Newtonian fluids.

Fluid Statics : Concept of pressure, Pascal's law and its engineering hydrostatic paradox. Action of fluid pressure on plane (horizontal, vertical and inclined) submerged surface, resultant force and center of pressure , force on a curved surface due to hydrostatic pressure. Buoyancy and flotation, stability of floating and submerged bodies, Meta centric height and its determination.

Fluid Kinematics: Classification of fluid flows, velocity and acceleration of fluid particle, local and convective acceleration, normal & tangential acceleration streamline, pathline and streakline, flow rate and discharge mean velocity continuity equation in Cartesian co-ordinates. Rotational flows- Rotational velocity and circulation, stream & velocity potential functions.

Fluid Dynamics :- Euler's equation, Bernoulli's equation and steady flow energy equation;representation of energy changes in fluid system, impulse momentum equation, kinetic energy and momentum correction factors, flow along a curved streamline, free and forced vortex motions.

Dimensional Analysis and Similitude: Fundamental and derived units and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's Pi method for dimensional analysis, dimension less number and their significance, geometric, kinematic and dynamic similarity, model studies.

Flow Past immersed bodies: Drag and lift deformation Drag and pressure drag. Drag on a sphere,cylinder and Airfoil: lift-Magnus Effect and circulation, lift on a circular cylinder.

Flow Measurement:- Manometers, Pitot tubes, venturimeter and orifice meters, orifices, mouth pieces, notches **(Rectangular and V-notches)** and weirs **(Sharp crested Weirs)**.

Suggested Readings / Books:

- Fluid Mechanics & Hydraulic Machines : Dr. R.K. Bansal
- Hydraulic and Fluid Mechanic by P.N.Modi & S.M.Seth
- Engineering Fluid Mechanics by R.J.Garde & A.G.Mirajgaoker
- Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Pitman
- Fluid Mechanics : Streetes VL & Wylie EB; Mcgraw Hill book company.
- Fluid Mechanics by White
- Introduction to Fluid Mechanics by Robert W.Fox & Alan T.McDonald
- Fluid Mechanics by Potter, Cengage Learning

BTCE302 Rock Mechanics & Engineering Geology

General Geology : Importance of Engg. Geology applied to Civil Engg. Practices. Weathering, definition, types and effect. Geological works of rivers, wind, glaciers as agents of erosion, transportation and deposition.

Rocks & Minerals : Minerals, their identification, igneous, sedimentary & metamorphic rocks. Classification of rocks for engineering purposes. Rock quality designation (RQD).

Structural Geology: Brief idea about stratification, apparent dip, true dip, strike and in conformities. Folds, faults & joints : definition, classification relation to engineering operations.

Engineering Geology: Geological considerations in the Engg. Projects like tunnels, highways, foundation, dams, reservoirs. Earthquake : Definition, terminology, earthquake waves, intensity, recording of earthquake.

Engineering properties of rocks and laboratory measurement : Uniaxial compression test, tensile tests, permeability test, shear tests, size and shape of specimen rate of testing. Confining pressure, stress strain curves of typical rocks. Strength of intact and fissured rocks, effect of anisotropy, effect of saturation and temperature

In-situ determination of Engg. Properties of Rock masses : Necessity of in-situ tests, uniaxial load tests in tunnels and open excavations, cable tests, flat jack test, shear test, pressure tunnel test. Simple methods of determining in situ stresses,bore hole test

Improvement in properties of Rock masses : Pressure grouting for dams and tunnels,
rock reinforcement rock bolting.

<u>Suggested Readings / Books:</u>

- Introduction to Rock Mechanics : Richard E. Goodman.
- Engg. Behaviour of rocks : Farmar, I.W.
- Rock Mechanics and Engg. : Jaager C.
- Fundamentals of Rock Mechanics : Jaager and Cook
- Engineering Geology : D.S.Arora
- Engineering Geology : Parbin Singh
- Rock Mechanics for Engineering : B.P. Verma.

BTCE 303 Strength of Material

Concept of Equilibrium: Load, reaction; General equilibrium equations; Equilibrium of a point in space; Equilibrium of a member; Concept of free body diagrams; Displacements; Concept of displacement-constraints/ supports; Statical-determinacy of a problem.

Simple Stress and Strains: Introduction; Concept of stress and strain; Stress-strain curves for ductile, brittle materials; Generalized Hooke's law, Stress-strain diagram of ductile and brittle material, statically determinate and indeterminate problems, compound and composite bars, thermal stresses. Elastic constants, relations between various elastic constants and its use;

Lateral strain, volumetric strain, poisons ratio; Stress and strains in thin cylinders, spherical shells; Thin vassals subjected to internal pressures.

Complex stress and strains: Introduction; Normal stress, tangential stress; Rectangular block subjected to normal stress along and across two planes, combination of normal and tangential stress; Concept of principal stress and its computation; Mohr circle; Principal strains, computation of principal stresses from the principal strains.

Shear force and Bending moment diagrams: Introduction to the concept of reaction diagrams—shear force and bending moment; Role of sign conventions; Types of load, beams, supports; Shear force and bending moment diagrams: simply supported, overhang and cantilever beams subjected to any combination of point loads, uniformly distributed and varying load, and moment; Relationship between load, shear force and bending moment; Different methods for plotting a bending moment and shear force diagrams.

Bending and Shear Stresses: Introduction; Assumptions and derivation of flexural formula for straight beams; Centroid of simple and built up section, second moment of area; Bending stress calculation for beams of simple and built up section, composite sections (flitched sections); Shear stress; Variation of bending and shear stress along the depth of section.

Columns and Struts: Stability of Columns; Buckling load of an axially loaded columns with various end conditions; Euler's and Rankine's formula; Columns under eccentric load, lateral load.

Torsion of Circular shafts: Torsion, basic assumptions, derivation of torsion equation; Power transmitted by shafts; analysis and design of solid and Hollow shafts based on strength and stiffness; Sections under combined bending and torsion, equivalent bending and torsion.

Failure theories: Maximum principal stress theory, Maximum shear stress theory, Distortion Energy theory, Strain Energy theory, Constant Analysis of Thin Cylinder

Suggested Readings / Books:

- Strength of Material by S. Ramamrutham
- Mechanics of Material : E .Popov
- Strength of Material : Rajput
- Strength of Materials : Sadhu Singh
- Strength of Materials by Gere, Cengage Learning

BTCE304 Surveying

Introduction: Definition, principles of surveying, different types of surveys, topographical map, scale of map.

Chain and Compass Surveying: Measurement of distances with chain and tape, direct & indirect ranging, offsets, bearing and its measurement with prismatic compass, calculation of angles from bearings.

Plane Table Surveying: Setting up the plane table and methods of plane tabling.

Levelling & Contouring: Setting up a dumpy level, booking and reducing the levels by rise & fall method and height of instrument method, correction due to curvature and refraction, characteristics of contours, methods of contouring, uses of contour maps.

Theodolite Traversing: Temporary and permanent adjustments, measurement of horizontal and vertical angles, adjustment of closing error by Bowditch & Transit rules.

Tachometry: Definition, determination of tachometer constants and reduced level from tachometric observations.

Triangulation: Selection of stations and base line, corrections for base line, satellite station and reduction to centre.

Curves: Elements of a simple curve, different methods of setting out of simple circular curve.

Suggested Readings / Books:

- Duggal, S.K., Surveying Vol I & II, Tata McGraw Hill (2006)
- Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I and II, Laxmi Publications (2005)
- Agor, R., Surveying, Khanna Publishers (1982)
- Bhavikatti,S.S. Surveying & Levelling Volume I&II (2009)

BTCE305 Building Material & Construction

Building Stones & Bricks: General , Characteristics of a good building stone, Deterioration and preservation of stones, Artificial Stones , Composition of good brick earth, Qualities of good bricks, Classification of bricks, Tests on bricks, Varieties of fire bricks.

Cement: Composition of cement, Raw Materials, Manufacturing process, Varieties of cement, Hydration of cement, Properties , testing of cement.

Concrete : Introduction, Constituents of concrete, Batching of materials, Manufacturing process of cement concrete, workability and factors affecting it, Methods to determine workability, segregation and bleeding of concrete, Strength of concrete and factors affecting it.

Timber: Structure of a tree , classification of trees, Defects in timber, Qualities of good a timber, Seasoning of timber , Decay of timber, Preservation of timber

Miscellaneous materials: Paints, Distempering, Glass, Plastics.

Foundation and Walls : Definition, types of foundations, causes of failures of foundation and remedial measures ,Types of walls and thickness considerations.

Brick and stone masonry: Terms used, Types of bonds & their merits and demerits, rubble and ashlar joints in stone masonry, cement concrete hollow blocks and their advantages and disadvantage.

Damp Proofing: Sources, causes and bad effects of dampness, preventive measures for dampness in buildings.

Roofs: Terms used, Classification of roofs and roof trusses, Different roof covering materials.

Plastering and pointing: Objects ,Methods of plastering , Materials and types, Defects in plastering, Special material for plastered surface, Distempering white washing and colour washing**.**

Floors: General ,Types of floors used in building & and their suitability, factors for selecting suitable floor for building**.**

Miscellaneous topics: Building Services – Plumbing service, Electrical services, Air conditioning, Accoustics and sound insulation, Fire protection measures, Lift

Suggested Readings / Books:

- Rangwala – Building materials
- Bindra SP, Arora KR Building construction
- Shetty MS , Concrete Technology
- Punmia BC, Building construction
- Singh, Parbin , Building materials
- Sushil Kumar , Building Construction

BTCE306 Fluid Mechanics Lab-I

1. To determine the meta-centric height of a floating vessel under loaded and unloaded conditions.
2. To study the flow through a variable area duct and verify Bernoulii's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (venturimeter /orifice meter)
4. To determine the discharge coefficient for a Vee notch or rectangular notch.
5. To determine the coefficient of discharge for Broad crested weir**.**
6. To determine the hydraulic coefficients for flow through an orifice.
7. To determine the friction coefficient for pipes of different diameter.
8. To determine the head loss in a pipe line due to sudden expansion / sudden contraction/ bend.
9. To determine the velocity distribution for pipe line flow with a pitot static probe.

Suggested Readings / Books:

- Practical Fluid Mechanics for Engineering Applications (Mechanical Engineering (Marcell Dekker) By John J. Bloomer
- Fluid Mechanics Practical Manual by S.Sarabjit Singh.

BTCE-307 Strength of Material Lab

List of experiments:

1. Draw Stress Strain curve for Ductile and Brittle material in tension.
2. Draw Stress Strain curve for Ductile and Brittle material in compression.
3. Draw shear stress, shear strain curve for ductile and brittle material in torsion strength testing
4. Draw load deflection curve for spring in loading and unloading conditions.
5. To determine the hardness of the given material by Rockwell and Brinell hardness testing machine.
6. To determine the fatigue strength of the material.
7. To determine the impact strength by Izod and Charpy test.

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8. To determine the load carrying capacity of the leaf spring.

9. To test a mild steel and cast iron specimen in double shear.

BTCE-305 Surveying Lab

1. Measurement of distance, ranging a line.

2. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.

3. Different methods of leveling, height of instrument, rise & fall methods.

4. Measurement of horizontal and vertical angle by theodolite.

5. Determination of tachometric constants and determination of reduced levels by tachometric observations.

6. Plane table survey, different methods of plotting, two point & three point problem.

7. Determination of height of an inaccessible object.

8. Setting out a transition curve. Setting out of circular curves in the field using different methods.

BTCE-309 Workshop Training

This will be held after 2nd Semester during Summer in the Institute Workshop for four weeks daily for 4 hrs. The students will be trained in the area of Carpentary, Electrical, Plumbing, Masonary and CAD work.

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BTCE-401 Geomatics Engineering

Internal Marks: 40 L T P
External Marks: 60 3 1 0
Total Marks: 100

1. Photogrammetry

Introduction, Basic Principles, Photo-Theodolite, Elevation of a Point by Photographic Measurement, Aerial Camera, Vertical Photograph, Tilted Photograph, Scale, Crab and Drift, Flight Planning for Aerial Photography, Ground Control for Photogrammetry, Photomaps and Mosaics, Stereoscopic Vision, Stereoscopic parallax, Stereoscopic Plotting Instruments, Applications.

2. Electromagnetic Distance Measurement (EDM)

Electromagnetic Waves, Carrier Waves, Black body radiation, Laws of radiation Modulation, Types of EDM Instruments, Electro-optical, Infrared, and Microwave EDM Instruments, Effect of Atmospheric Conditions, The Geodimeter, The Tellurometer, Wild Distomats, Electronic Total Station.

3. Remote Sensing

Introduction, Basic Principles, Electromagnetic (EM) Energy Spectrum, EM Radiations and the Atmosphere, Interaction of EM radiations with Earth's Surface, Types of remote sensing systems, Remote Sensing Observation Platforms, Satellites and their characteristics – Geo-stationary and sun-synchronous, Earth Resources Satellites, Meteorological satellites, Sensors, Types and their characteristics, Across track and Along track scanning, Applications of Remote Sensing.

4. Geographical Information System (GIS)

Definition, GIS Objectives, Hardware and software requirements for GIS, Components of GIS, Coordinate System and Projections in GIS, Data structure and formats, Spatial data models – Raster and Vector, Data inputting in GIS, Data base design - editing and topology creation in GIS, Linkage between spatial and non spatial data, Spatial data analysis – significance and type, Attribute Query, Spatial Query, Vector based spatial data analysis, Raster based spatial data analysis, Errors in GIS, Integration of RS and GIS data, Digital Elevation Model, Network Analysis in GIS, GIS Software Packages.

5. Global Positioning System (GPS)

Introduction, Fundamental concepts, GPS system elements and signals, GPS measurements and accuracy of GPS, Satellite Movement, GPS Satellites, Co-ordinate systems - Geoids, Ellipsoid and Datum, Spheroid, Customised Local Reference Ellipsoids, National Reference Systems, Worldwide Reference Ellipsoid, WGS 84, Differential-GPS, Classification of GPS receivers, GPS Applications.

Books Recommended:

1. Arora, K.R., 2007: Surveying Vol-III, Standard Book House.
2. Campbell, J.B.2002: Introduction to Remote Sensing. Taylor Publications.
3. Chang.T.K. 2002: Geographic Information Systems, Tata McGrawHill.
4. Heywood.I, Cornelius S, CrverSteve. 2003: An Introduction to Geographical Information Systems, Pearson Education.
5. Joseph George, 2003: Fundamentals of Remote Sensing. Universities Press.
6. Punmia, B.C., Jain A.K., 2005: Higher Surveying, Luxmi Publications
7. Sabbins, F.F., 1985: Remote Sensing Principles and Interpretation. W.H.Freeman and company.
8. Kaplan, E.D., Understanding GPS : Principles and Application; Artec House; 2 Edition

BTCE-402 CONSTRUCTION MACHINERY & WORKS MANAGEMENT

Internal Marks: 40 L T P
External Marks: 60 3 1 0
Total Marks: 100

1. INTRODUCTION : Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs.

2. PERT : Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project, numerical problems.

3.CPM : Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control, numerical problems.

4. COST ANALYSIS AND CONTRACT : Type of costs, cost time relationships, cost slopes, conducting a crash programme, determining the minimum total cost of project, numerical problems. updating a project, when to update, time grid diagram, resource scheduling. planning of different components of civil engineering projects such as a house, workshop, dam, tunnel.

5. CONSTRUCTION EQUIPMENT AND MACHINERY : Tractors, bull dozers, rippers, scrappers, power shovels, dragline, hoes. Line diagram of each, sizes, output, uses, factors affecting selection of each equipment, economic life of equipment,maintenance and repair cost.

Hoisting & Transporting Equipments: Hosts, Winches, Cranes, Belt conveyors, Ropeways, trucks & Wagons.

6. : Plants for grading, batching, mixing, types of mixers, concrete pumps, bitumen plants.

BOOKS RECOMMENDED:

Construction Planning and Equipment - R.L.Peurifoy - Tata McGraw Hill, New Delhi
PERT and CPM - L.S.Srinath, East West Press
Management Guide to PERT & CPM - Wiest & levy; Prentice Hall
Construction Equipment & Planning and Application. - Mahesh Verma Artec Publication.
Construction Planning and Management by U. K. Shrivastava; Galgotia Publications Pvt. Ltd.

BTCE-403 DESIGN OF CONCRETE STRUCTURES-I

Internal Marks: 40 — L T P

External Marks: 60 — 4 1 0

Total Marks: 100

Note: Relevant Indian Code of Practices are permitted in Examination.

Part A: CONCRETE TECHNOLOGY

1. CEMENTS & ADMIXTURES: Portland cement – chemical composition – Hydration, Setting of cement – Structure of hydrate cement – Test on physical properties – Different grades of cement – Admixtures – Mineral and chemical admixtures.

2. AGGREGATES: Classification of aggregate – Particle shape & texture – Bond, strength & other mechanical properties of aggregate – Specific gravity, Bulk density, porosity, adsorption & moisture content of aggregate – Bulking of sand – Deleterious substance in aggregate – Soundness of aggregate – Alkali aggregate reaction – Thermal properties – Sieve analysis – Fineness modulus – Grading curves – Grading of fine & coarse Aggregates – Gap graded aggregate – Maximum aggregate size.

3. Properties of Concrete: Workability – Factors affecting workability – Measurement of workability by different tests – Setting times of concrete – Effect of time and temperature on workability – Segregation & bleeding – Mixing and vibration of concrete – Steps in manufacture of concrete – Quality of mixing water, Abram's Law , Factors affecting strength; Characteristics strength of concrete, Target strength, Modulus of elasticity, Modulus of rupture

4. MIX DESIGN : Factors in the choice of mix proportions – Durability of concrete – Quality Control of concrete – Statistical methods – Acceptance criteria – Proportioning of concrete mixes by various methods – BIS method of mix design.

Part B: **DESIGN OF REINFORCED CONCRETE ELEMENTS**

1. Objectives and Methods of Analysis and Design
2. Properties of Concrete and Steel
3. Design Philosophies of Working Stress Method and Limit State Method
4. Limit State of Collapse - Flexure
5. Computation of Parameters of Governing Equations
6. Determination of Neutral Axis Depth and Computation of Moment of Resistance
7. Numerical Problems on Singly Reinforced Rectangular Beams
8. Doubly Reinforced Beams – Theory and Problems
9. Flanged Beams – Theory and Numerical Problems
10. Shear, Bond, Anchorage, Development Length and Torsion
11. Reinforced Concrete Slabs: One and Two way Slabs

BOOKS:

1. Properties of Concrete by A.M.Neville – Prentice Hall
2. Concrete Technology by M.S.Shetty. – S.Chand & Co.;
3. Concrete Technology by M.L. Gambhir. – Tata Mc. Graw Hill Publishers, New Delhi
4. Concrete Technology by A.R. Santha Kumar, Oxford university Press, New Delhi
5. Advanced Design of Structures N. Krishna Raju

6. Advanced RCC Design Pillai & Mennon
   ; Tata MacGraw Hill
7. Limit State Design Ramachandra

8. Limit State Design A.K. Jain

9. Limit State Design of Reinforced Concrete P.C. Vergese

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BTCE- 404 Fluid Mechanics-II

Internal Marks: 40 **L T P**
External Marks: 60 **3 1 0**
Total Marks: 100

1. Laminar Flow: Navier-stokes equations in Cartesian coordinates (no derivation), meaning of terms ,Flow through circular section pipe, flow between parallel plates, stokes law. Flow through porous media,. Transition from laminar to turbulent, Critical velocity and critical Reynolds Number

2. Turbulent Flow: Turbulent flows and flow losses in pipes, Darcy equation minor head losses in pipe fittings, hydraulic and energy gradient lines. Definition of turbulence, scale and intensity, Effects of turbulent flow in pipes. Equation for velocity distribution in smooth and rough pipes (no derivation). Resistance diagram.

3. Boundary Layer Analysis: Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

4. Uniform flow in open Channels: Flow classifications, basic resistance Equation for open channel flow. Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, conveyance and normal depth. Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular.

5. Energy and Momentum principles and critical flow: Energy and specific Energy in an open channel;critical depth for rectangular and trapezoidal channels. Alternate depths, applications of specific energy to transitions and Broads crested weirs. Momentum and specific force in open channel flow, sequent depths.

6. Gradually varied Flow: Different Equation of water surface profile; limitation, properties and classification of water and surface profiles with examples, computation of water surface profile by graphical, numerical and analytical approaches.

7. Hydraulic Jump and Surges: Theory of Jump, Elements of jump in a rectangular Channel, length and height of jump, location of jump, Energy dissipation and other uses, Positive and negative surges

Books:

5. Hydraulics & Fluid Mechanics by P.N.Modi and S.M.Seth; Standard Publication
6. Flow in Open Channels by S.Subraminayam; Tata MacGraw Hill
7. Introduction to Fluid Mechanics by Robert N.Fox & Alan T.Macnold
8. Fluid Mechanics : Dr. R.K. Bansal; Laxmi Publications
9. Fluid Mechanics : Dr. Jagdish Lal; Metropolitan Book Co. (p) Ltd.

BTCE-405 IRRIGATION ENGINEERING –I

Internal Marks: 40	L T P
External Marks: 60	3 1 0
Total Marks: 100	

1. **INTRODUCTION**:Importance of Irrigation Engineering, purposes of Irrigation, objectives of Irrigation, Benefits of Irrigation, Advantages of various techniques of irrigation- - Furrow Irrigation, Boarder strip Irrigation, Basin Irrigation, Sprinkler Irrigation , Drip Irrigation.
2. **METHODS OF IRRIGATION**:Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta , Duty of water, Base Period, relation between delta, duty and base period, Soil crop relation-ship and soil fertility.
3. **CANAL IRRIGATION**:Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories.
4. **LINED CANALS**:Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining.
5. **LOSSES IN CANALS, WATER LOGGING AND DRAINAGE**:Losses in canals- Evaporation and seepage, water logging, causes and ill effects of water logging anti wter logging measures. Drainage of land, classification of drains - surface and subsurface drains, Design considerations for surface drains, Advantages and maintenance of tile drains.
6. **INVESTIGATION AND PREPARATION OF IRRIGATION PROJECTS**: Classification of project, Project preparation-investigations, Design of works and drawings,concept of multi - purpose projects, Major, Medium and miner projects, planing of an irrigation project, Economics & financing of irrigation works. Documentation of project report.
7. **TUBE - WELL IRRIGATION** :Types of tube wells - strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability,transmissibility and storage. Yield or discharge of a tube well, Assumptions , Theim's & Dupuit’s formulae, Limitations of Theim's and Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, causes of failure of tubewells, optimum capacity, Duty and delta of a tube well. Rehabilitation of tubewell.
8. **RIVER TRAINING WORKS**:Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs - Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, Natural cut-offs and Artificial cut-offs and design Considerations.

Books:-

Principles & practice of Irrigation Engg. S.K.Sharma; S. Chand, Limited.
Irrigation & Water Power Engg. B.C. Punmia, Pande B.B.Lal; Laxmi Publications (p) Ltd
Fundamentals of Irrigation Engg. Dr. Bharat Singh; Nem Chand & Bros
Irrigation Engg. & Hydraulic Structure S.R.Sahasrabudhe; S. K. Kataria & Sons
Irrigation Engg. & Hydraulic Structure Varshney, Gupta & Gupta; Nem Chand and Brothers
Irrigation Engg. & Hydraulic Structure Santosh Kumar Garg; Khanna Publishers

BTCE- 406 STRUCTURAL ANALYSIS- I

Internal Marks: 40 L T P
External Marks: 60 3 2 0
Total Marks: 100

Displacements: Concept; Governing differential equation for deflection of straight beams; Following methods for determination of structural displacements:

10. Geometric Methods: Double integration; Macaulay� method; Moment area method; Conjugate beam method.
11. Energy Methods: Strain energy in members, , Betti’s and Maxwell’s Laws of reciprocal deflections, Concept of Virtual work and its applications, Castigliano’s theorems, unit load method, deflections of trusses and 2D-frames.

Determinate Structures: Concept of determinacy; Analysis of determinate structural elements—truss, arch, beam, frame, cables; Internal forces in determinate structures; Reaction diagram-- Bending moment, shear force, radial shear, normal thrust diagrams for the determinant structures.

12. Analysis of plane trusses, compound and complex trusses using method of joints, method of joints, tension coefficients.
13. Analysis of three-hinged arch of various shapes under different loading conditions.
14. Analysis of simple portal frame, cables under different loading conditions.
15. Analysis of cables under point load and UDL with ends at same or different levels.

Moving Loads and Influence Line Diagrams: Concept of influence line diagram, rolling loads; Bending moment and shear force diagrams due to single and multiple concentrated rolling loads, uniformly distributed moving loads; Equivalent UDL; Muller Breslau principle; Influence lines for beams, girders with floor beams and frames; calculation of the maximum and absolute maximum shear force and bending moment; Concept of envelopes; Influence line for displacements; Influence line for bar force in trusses.

Analysis of Cables and Suspension Bridges: General cable theorem, shape, elastic stretch of cable, maximum tension in cable and back-stays, pressure on supporting towers, suspension bridges, three hinged stiffening girders.

Analysis of Dams, Chimneys and Retaining Walls: Introduction, loadings for the dames, chimneys, and retaining walls; limit of eccentricity for no-tension criteria; Concept of core; Middle-third rule; maximum/minimum base pressures.

Book Recommended

1 Basic structural Analysis C.S.Reddy; Tata McGraw-Hill Education
2 Analysis of Structures Vol- I and Vol.-II Vazirani & Ratwani; Khanna Publishers
3 Intermediate structural Analysis C.K.Wang; McGraw-Hill
4 Advanced Structural Analysis, A.K. Jain, Nem Chand & Bros., Roorkee.
5 Theory of Structures, Vol. I, S.P. Gupta & G.S.Pandit, Tata McGraw Hill, New Delhi.

BTCE-407 CONCRETE TECHNOLOGY LAB

Internal Marks: 30 L T P
External Marks: 20 0 0 2
Total Marks: 50

List of experiments:

1. To Determine the Specific Gravity of and Soundness of cement
2. To Determine the Standard Consistency, Initial and Final Setting Times of Cement and Compressive Strength of Cement.
3. To Determine the Fineness Modulus, Bulk Density, Water Absorption and Specific gravity of Fine and Coarse Aggregates.
4. To Determine the Slump, Compaction Factor and Vee-Bee Time of Concrete.
5. Mix Design of Concrete by IS methods
6. To Determine the Compressive Strength of Concrete by Cube and Cylinder.
7. To carry out the Split Tensile and Flexural strength of Concrete.
8. Compressive strength of Brick and Tile as IS standard

Books/Manuals :-

1. Concrete Manual By Dr. M.L. Gambhir, Dhanpat Rai & Sons Delhi.
2. Concrete Lab Manual by TTTI Chandigarh
3. Concrete Technology, Theory and Practice by M.S.Shetty. S.Chand & Company.

BTCE-408 Structural Analysis Lab

Internal Marks: 30 **L T P**

External Marks: 20 **0 0 2**

Total Marks: 50

List of Experiments

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.
3. To verify the Moment- area theorem for slope and deflection of a given beam.
4. Deflection of a fixed beam and influence line for reactions.
5. Deflection studies for a continuous beam and influence line for reactions.
6. Study of behavior of columns and struts with different end conditions.
7. Experiment on three-hinged arch.
8. Experiment on two-hinged arch.
9. Deflection of a statically determinate pin jointed truss.
10. Forces in members of redundant frames.
11. Experiment on curved beams.
12. Unsymmetrical bending of a cantilever beam.

References:

A Laboratory Manual on Structural Mechanics by Dr. Harwinder Songh; New Academic Publishing Comp. Ltd.

Fifth Semester

BTCE 501 Design of Steel Structures – I

Internal Marks: 40 — L T P
External Marks: 60 — 3 2 0
Total Marks: 100

Note: Relevant Indian Codes of Practice are permitted in Examination.

1. **Introduction:** Properties of structural steel, I.S. rolled sections, I.S. specifications.
2. **Connections:** Riveted, bolted and welded connections for axial and eccentric loads.
3. **Tension members:** Design of members subjected to axial tension.
4. **Compression members:** Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens.
5. **Flexural members:** Design of laterally restrained and un-restrained rolled and built-up sections, encased beams.
6. **Column bases:** Design of slab base, gusseted base and grillage foundation.
7. **Roof truss:** Design loads, combination of loads, design of members (including purlins) and joints, detailed working drawings.

BOOKS & CODES RECOMMENDED:

1) Limit state design of steel structures: S K Duggal, Mc Graw Hill
2) Design of steel structures: N Subramanian Oxford Higher Education
3) Design of steel structures (Vol. 1): Ram Chandra Standard Book House - Rajsons
4) Design of steel structures (by limit state method as per IS: 800-2007): S S Bhavikatti *I K* International *Publishing* House
5) IS 800: 2007 (General construction in steel-Code of practice)*
6) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*

* permitted in Examination

BTCE-502 Geotechnical Engineering

Internal Marks: 40 **L T P**
External Marks: 60 **3 2 0**
Total Marks: 100

1. **Basic Concepts**: Definition of soil and soil mechanics, common soil mechanics problems in Civil Engineering. Principal types of soils. Important properties of very fine soil. Characteristics of main Clay mineral groups. Weight volume relationship and determination of specific gravity from pycnometer test. Field density from sand replacement method and other methods.
2. **Index Properties**: Grain size analysis. Stokes's law and Hydrometer analysis. Consistency and sensitivity of Clay, Atterbeg Limits, Flow Index and Toughness Index. Underlying theory of shrinkage limit determination. Classification of coarse and fine grained soils as per Indian Standard.
3. **Compaction**: Definition and object of compaction and concept of O.M.C. and zero Air Void Line.Modified proctor Test. Factors affecting compaction Effect of compaction on soil properties and their discussion. Field compaction methods- their comparison of performance and relativesuitability. Field compacative effort, Field control of compaction by proctor.
4. **Consolidation**: Definition and object of consolidation, Difference between compaction and consolidation. Concept of various consolidation characteristics i.e. a_v, m_v and c_v, primary and secondary consolidation. Terzaghi's Differential equation and its derivation. Boundary conditions for Terzaghi's solution for one dimensional consolidation concept of c_v, t_v & U. consolidation test determination of c_v from curve fitting methods, consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over-consolidation. Effect of disturbance on e-Logσ curves of normally consolidated clays, importance of consolidation settlement in the design of structures.
5. **Permeability and Seepage**: Concept of effective stress principal, seepage pressure, critical hydraulic gradient and quick sand condition. Capillary phenomenon in soil. Darcy's Law and its validity, seepage velocity, co-efficient of permeability (k) and its determination in the laboratory. Average permeability of startified soil mass, factors affecting 'k' and brief discussion.
6. **Shear Strength**: Stress analysis of a two dimensional stress system by Mohr circle. Concept of pole. Coulomb's law of shear strength coulomb - Mohr strength theory. Relation between principal stesses at failure. Direct, triaxial and unconfined shear strength tests. Triaxial shear tests based on drainage conditions typical strength envelopes for clay obtained from these tests. Derivation of skempton's pore pressure parameters. Stress strain and volume change characteristics of sands.
7.**Stability of Slopes**: slope failure, base failure and toe failure - Swedish circle method - φ=0 analysis and c=0 analysis - friction circle method - Taylor's stability number - stability charts - sliding block analysis

Books:-

1. Soil Mech. & Foundation Engg, by K.R.Arora Standard *Publishers* Distributors
2. Geotechnical Engineering, by P. Purshotama Raj *Tata Mcgraw Hill*
3. Soil Mech. & Foundation Engg., by V.N.S.Murthy CBS *Publishers* & Distributors.
4. Principle of Geotechnical Engineering by B.M.Das Cengage Publisher
5. Basic and applied Soil Mechanics by Gopal Ranjan and A.S.R.Rao New Age International Publishers
6. Geotechnical Engineering by Gulati and Datta, Tata McGraw Hill

7. Problems in Soil mechanics and Foundation Engineering by B.P.Verma, Khanna Publishers.

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BTCE-503 Structural Analysis-II

Internal Marks: 40	**L T P**
External Marks: 60	**3 2 0**
Total Marks: 100	

Pre-requisite: Structural Analysis-1

Indeterminate Structures: Concept of indeterminate /redundant structures; Static and kinematic indeterminacies; stability of structures; internal forces; Conditions of stress-strain relationships, equilibrium and compatibility of displacements; Solution of simultaneous algebraic equations.

Indeterminate Structural Systems: Pin-jointed and rigid-jointed structural systems; Deformation of redundant structures-sway and non-sway frames, elastic curve; Static equilibrium and deformation compatibility checks; Effects of support settlement and lack of fit; Fixed-end moments—member loading, sinking of supports, temperature; Analysis of redundant beams, frames, trusses, arches using following methods:

a) **Conventional Methods: Slope deflection method; Moment distribution method; Rotation contribution method (Kani's Method).**
b) **Classical Methods:** Methods of consistent deformation; Theorem of three moments.
c) **Approximate Methods:** Portal method; Cantilever method; Substitute frame method.

Influence Line Diagrams: Concept and application in the analysis of statically indeterminate structures; Influence line for bar forces in the statically indeterminate trusses, beams and frames.

RECOMMENDED BOOKS :

1. Basic structural analysis - C.S. Reddy Tata McGraw-Hill
2. Intermediate structural analysis - C . K. Wang. McGraw Hill
3. Indeterminate structural analysis - J. Sterling Kinney Addison-Wesley Educational Publishers
4. Theory of structures - B.C. Punima, Laxmi Publications
5. Structural Analysis, Devdas Menon, Narosa Publishers.

BTCE-504 Transportation Engineering – I

Internal Marks: 40 | L T P
External Marks: 60 | 3 1 0
Total Marks: 100

Highway Engineering

1. **Introduction:** Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.
2. **Highway Development & Planning**: Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys.
3. **Highway Alignment**: Requirements, Alignment of Hill Roads, Engineering Surveys.
4. **Highway Geometric Design**: Cross Section Elements, Carriageway, Camber, Sight Distances, Horizontal Curves, Extra-widening, Super-elevation, Vertical Curves.
5. **Highway Materials**: Properties of Sub-grade and Pavement Component Materials, Tests on Sub-grade Soil, Aggregates and Bituminous Materials.
6. **Highway Construction**: Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements.
7. **Highway Drainage and Maintenance**: Importance of drainage and maintenance, Surface Drainage and Subsoil Drainage, Construction in Water-logged areas, Pavement Failures, Pavement Evaluation, Maintenance and Strengthening Measures.
8. **Highway Economics & Financing**: Total Transportation Cost, Economic Analysis, Sources of Highway Financing.

Traffic Engineering

9. **Traffic Characteristics**: Road User Characteristics, Driver Characteristics, Vehicular Characteristics.
10. **Traffic Studies**: Volume Studies, Speed Studies, O-D Survey, Parking Study.
11. **Traffic Safety and Control Measures**: Traffic Signs, Markings, Islands, Signals, Cause and Type of Accidents, Use of Intelligent Transport System.
12. **Traffic Environment Interaction**: Noise Pollution, Vehicular Emission, Pollution Mitigation Measures.

Books Recommended:

1. Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee, 1998.
2. Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.
3. Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
4. Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.
5. Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, New Delhi.

BTCE-505 Environmental Engineering - I

Internal Marks: 40	**L T P**
External Marks: 60	**3 1 0**
Total Marks: 100	

1. Introduction: Beneficial uses of water, water demand, per capita demand, variations in demand, water demand for fire fighting, population forecasting and water demand estimation.

2. Water sources and development: Surface and ground water sources; Selection and development of sources; Assessment of potential; Flow measurement in closed pipes, intakes and transmission systems.

3. Pumps and pumping stations: Types of pumps and their characteristics and efficiencies; Pump operating curves and selection of pumps; pumping stations.

4. Quality and Examination of Water: Impurities in water, sampling of water, physical, chemical and bacteriological water quality parameters, drinking water quality standards and criteria.

5. Water treatment: Water treatment schemes; Basic principles of water treatment; Design of plain sedimentation, coagulation and flocculation, filtration – slow, rapid and pressure; Disinfection units; Fundamentals of water softening, fluoridation and deflouridation, and water desalination and demineralization, taste and odour removal.

6. Transportation of Water: Pipes for transporting water and their design, water distribution systems and appurtenances; Water supply network design and design of balancing and service reservoirs; operation and maintenance of water supply systems.

7. Rural water supply: Principles, selection of source, rain water harvesting, quantitative requirements, low cost treatment techniques.

Books:-

1. Water Supply Engineering- Environmental Engg. (Vol. – I) by B.C. Punmia, Ashok Jain, Arun Jain, Laxmi Publications, New Delhi.
2. Environmental Engg. - A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi.
3. "Environmental Engg." By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
4. Water Supply Engineering- Environmental Engg. (Vol. – I) by S.K. Garg, Khanna Publishers, Delhi.
5. Water Supply and Sewerage by Steel EW and McGhee, Terence J.; McGraw Hill.

BTCE-506 Transportation Engineering Lab

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

I Tests on Sub-grade Soil

1. California Bearing Ratio Test

II Tests on Road Aggregates

2. Crushing Value Test
3. Los Angles Abrasion Value Test
4. Impact Value Test
5. Shape Test (Flakiness and Elongation Index)

III Tests on Bituminous Materials and Mixes

6. Penetration Test
7. Ductility Test
8. Softening Point Test
9. Flash & Fire Point Test
10. Bitumen Extraction Test

IV Field Tests

11. Roughness Measurements Test by Roughometer
12. Benkelman Beam Pavement Deflection Test

Books/Manuals Recommended :

1. Khanna S.K., and Justo, C.E.G. “Highway Material & Pavement Testing”, Nem Chand and Brothers, Roorkee.

BTCE-507 Geotechnical Engineering Lab

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 2**
Total Marks: 50

1. Determination of in-situ density by core cutter method and Sand replacement method.
2. Determination of Liquid Limit & Plastic Limit.
3. Determination of specific gravity of soil solids by pyconometer method.
4. Grain size analysis of sand and determination of uniformity coefficient (Cu) and coefficient of curvature (Cc).
5. Compaction test of soil.
6. Determination of Relative Density of soil.
7. Determination of permeability by Constant Head Method.
8. Determination of permeability by Variable Head method.
9. Unconfined Compression Test for fine grained soil.
10. Direct Shear Test
11. Triaxial Test
12. Swell Pressure Test

Books Recommended:-
Soil Testing Engineering, Manual By Shamsher Prakash and P.K. Jain. Nem Chand & Brothers

BTCE-508 Computer Aided Structural Drawing

Internal Marks: 30 **L T P**
External Marks: 20 **0 0 3**
Total Marks: 50

1) Structural Drawings of Reinforced Concrete Elements such as Beams, Slabs.

2) Structural Drawings of Steel Elements such as Connections, Tension Members, Compression Members, Beams, Column Base, and Roof Trusses.

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BTCE-509 Survey Camp

Internal Marks: 100
External Marks: 50
Total Marks: 150

Survey Camp of 4 weeks duration will be held immediately after IVth semester at a Hilly Terrain. The students are required to prepare the Topographical Map of the area by traditional method. Students should also be exposed to modern Survey Equipment and practices, like Total Station, Automatic Level, GPS etc.

Sixth Semester

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BTCE-601 DESIGN OF CONCRETE STRUCTURES-II

Internal Marks: 40	L T P
External Marks: 60	4 1 0
Total Marks: 100	

Note: Relevant Indian Codes of Practice and Design handbooks are permitted (as per note mentioned below) in Examination.

1. Stairs : Types and Design of Stairs
2. Foundations - Theory and Design: Isolated Footing (Square, Rectangular), Combined Footing(Rectangular, Trapezoidal, Strap), Raft Footing
3. Compression Members: Definitions, Classifications, Guidelines and Assumptions, Design of Short Axially Loaded Compression Members, Design of Short Compression Members under Axial Load with Uniaxial and biaxial Bending, Preparation of Design Charts, Design of Slender Columns
4. Design of Continuous beams and curved beam.
5. Design of Domes.
6. Design of Retaining walls: Cantilever type retaining wall, Counterfort type retaining wall.
7. Introduction to water retaining structures. Design of circular and rectangular water tanks resting on ground.

Books:

1. Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education
2. Limit state Design of Reinforced Concrete; Varghese P C; Prentice-Hall of India Pvt. Ltd".
3. Reinforced Cement Concrete, Mallick and Rangasamy; Oxford-IBH.

BIS Codes of practice and Design Handbooks:

1. *IS 456-2000*- Indian Standard. Plain and Reinforced concrete -Code of practice
2. *IS 3370- Code of practice for concrete structures for storage of liquids
3. *Design Aid SP 16
4. Explanatory hand book SP24.
5. Detailing of Reinforcement SP 34

Note: The codes marked with * are permitted in examination.

BTCE-602 ELEMENTS OF EARTHQUAKE ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 2 0
Total Marks :	100	

Note: No Indian Codes of Practice and Design handbooks are permitted, so paper setter is expected to provide required data from relevant IS codes, for any numerical or design part.

1. Introduction to Earthquakes, Causes of Earthquakes, Basic Terminology, Magnitude, Intensity, Peak ground motion parameters.
2. Past Earthquakes and Lessons learnt, Various Types of Damages to Buildings.
3. Introduction to theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, Spring action and damping, Equation of motion of S.D.O.F. systems, Undamped, Damped system subjected to transient forces, general solution, green's function.
4. Lateral Force analysis, Floor Diaphragm action, moment resisting frames, shear walls.
5. Concepts of seismic design, Lateral Strength, Stiffness, ductility and structural configuration.
6. Introduction to provisions of IS 1893-2002 Part-I for buildings. Estimation of lateral forces due to earthquake.
7. Introduction to provisions of IS 4326.
8. Introduction to provision of IS 13920.

References :

1. Earthquake Resistant Design of Structures, Pankaj Agrawal, Manish Shrikhande, PHI Learning
2. Dynamics of Structures: Theory and Applications to Earthquake Engineering, AK Chopra, Prentice Hall
3. Dynamics of Structures, R.W. Clough and Joseph Penzien, McGraw-Hill Education
4. Structural Dynamics by Mario & Paz, Springer.
5. Earthquake Resistant Design by David J. Dowrick, Wiley India Pvt Ltd
6. Elements of Earthquake Engg by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, South Asian Publishers.
7. IS 1893-2002 Indian Standard Criteria for Earthquake Resistant Design of Structures.
8. IS 4326-1993 2002 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
9. IS 13920-1993 2002 Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces.

BTCE-603 FOUNDATION ENGINEERING

Internal Marks: 40	L T P
External Marks: 60	4 1 0
Total Marks: 100	

Soil Investigation: Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance. Essential features and application of the following types of samples-
Open Drive samples, Stationery piston sampler, Rotary sampler, Geophysical exploration by seismic and resistivity methods. Bore Hole log for S.P.T.

Earth Pressure Terms and symbols used for a retaining wall. Movement of all and the lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium, K_a and K_p for horizontal backfills. Rankine's theory both for active and passive earth pressure for Cohesionless backfill with surcharge and fully submerged case. Cohesive backfill condition. Coulomb's method for cohesion less backfill. Merits and demerits of Ranking and Coulomb's theories, Culmann's graphical construction (without surcharge load).

Shallow Foundation: Type of shallow foundations, Depth and factors affecting it.Definition of ultimate bearing capacity, safe bearing capacity and allowable bearing capacity. Rankine's analysis and Terzaghi's analysis.Types of failures. Factors affecting bearing capacity. Skemptons equation. B.I.S.recommendations for shape, depth and inclination factors. Plate Load test and standard penetrationTest.
Bosussinesq equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams. Newmarks chart and its construction. 2:1 method of load distribution. Comparison of Bosussinesq and Westerguard analysis for a point load. Causes of settlement of structures, Comparison of immediate and consolidation settlement, calculation of settlement by plate load Test and Static Cone penetration test data. Allowable settlement of various structures according to I.S. Code. Situation most suitable for provision of rafts, Proportioning of rafts,Methods of designing raft, Floating foundation.

Pile Foundations: Necessity and uses of piles, Classification of piles, Merits and demerits of different types based on composition. Types of pile driving hammers & their comparison. Effect of pile driving on adjacent ground. Use of Engineering News Formula and Hiley's Formula for determination of allowable load. Limitations of pile driving formulae. Cyclic Pile Load Test, Separation of skin friction and point resistance using cyclic pile load test.
Determination of point resistance and frictional resistance of a single pile by Static formulas. Piles in Clay, Safe load on a Friction and point Bearing pile. Pile in sand, Spacing of piles in a group, Factors affecting capacity of a pile group, Efficiency of pile group by converse - Labare formula and feeds formulas. Bearing capacity of a pile group in clay by block failure and individual action approach. Calculation of settlement of friction pile group in clay. Related Numerical problems. Settlement of pile groups in sand, Negative skin friction.Related numerical problem

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Caissons and Wells: Major areas of use of caissons, advantages and disadvantages of open box and pneumatic caissons. Essential part of a pneumatic caisson. Components of a well foundation.Calculation of allowable bearing pressure. Conditions for stability of a well, Forces acting on a well foundation. Computation of scour depth.

Books -

1. Soil Mech. & Foundation Engg, by K.R.Arora, Standard Publishers Distributors
2. Geotechnical Engineering, by P. Purshotama Raj
3. Soil Mech. & Foundation Engg., by V.N.S.Murthy
4. Principle of Foundation Engineering by B.M.Das, CL Engineering
5. Basic and applied Soil Mechanics by Gopal Ranjan and A.S.R.Rao, New Age International
6. Soil Mech. & Foundations by Muni Budhu Wiley, John Wiley & Sons
7. Geotechnical Engineering by Gulhati and Datta, Tata McGraw - Hill Education
8. Foundation Engineering by Varghese P.C, PHI Learning.
9. Problems in Soil mechanics and Foundation Engineering by B.P.Verma, Khanna Publication.
10. Foundation Analysis and Design by Bowles J.E, Tata McGraw - Hill Education

BTCE-604 NUMERICAL METHODS IN CIVIL ENGINEERING

Internal Marks: 40	L T P
External Marks: 60	4 1 0
Total Marks: 100	

1. **Equation**: Roots of algebraic transcendental equation, Solution of linear simultaneous equations by different methods using Elimination, Iteration, Inversion, Gauss-Jordan and method. Homogeneous and Eigen Value problem, Nonlinear equations, Interpolation.
2. **Finite Difference Technique**: Initial and Boundary value problems of ordinary and partial differential equations, Solution of Various types of plates and other civil engineering related problems
3. **New Marks Methods**: Solution of determinate and indeterminate structures using Newmarks Procedure (Beam)
4. **Statistical Methods**: Method of correlation and Regression analysis for fitting a polynomial equation by least square
5. **Initial Value problem**: Galerkin's method of least square, Initial Value problem by collocation points, Rungekutta Method
6. **New Marks Method:** Implicit and explicit solution, solution for nonlinear problems and convergence criteria

Books:

1. Numerical Mathematical Analysis: James B. Scarborough Oxford and IBH Publishing, 1955.
2. Introductory Methods of Numerical Analysis: S.S. Sastry, PHI Learning (2012).
3. Introduction To Computer Programming and Numerical Methods by Xundong Jia and Shu Liu, Dubuque, Iowa: Kendall/Hunt Publishing Co.
4. Numerical Methods, J.B Dixit , USP (Laxmi publication),

BTCE-605 PROFESSIONAL PRACTICE

Internal Marks: 40	L T P
External Marks: 60	3 2 0
Total Marks: 100	

1. **Estimates**-Method of building estimates, types, site plan index plan, layout plan, plinth area, floor area, Technical sanction, administrative approval, estimate of buildings, roads, earthwork, R.C.C. works, sloped roof, roof truss, masonry platform, complete set of estimate.
2. **Schedule of Rates, analysis of rates**- For earthwork, concrete work, D.P.C., stone masonry, plastering, pointing, roadwork
3. **Specifications**- For different classes of building and Civil engineering works.
4. Rules and measurements for different types of Civil engineering works.
5. **Types of contracts**- Tenders, tender form, submission and opening of tenders, measurement book, muster roll , piecework agreement and work order
6. **Accounts**-Division of accounts, cash, receipt of money, cash book, temporary advance, imprest, accounting procedure
7. **Arbitration**: Acts and legal decision making process.

Books Recommended

1. Estimating and Costing by B.N. Datta, UBSPD, New Delhi
2. Estimating and Costing by G.S. Birdie, Dhanpat Rai Publication New Delhi .
3. Estimating and Costing by V.N. Chakravorty, Calcutta
4. Civil Engg. Contracts & Estimates by B.S. Patil, Orient-Longman Ltd., New Delhi.

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BTCE-606 ENVIRONMENTAL ENGINEERING - II

Internal Marks: 40	L T P
External Marks: 60	3 1 0
Total Marks: 100	

1. Introduction: Terms & definitions, systems of sanitation and their merits and demerits, system of sewerage, choice of sewerage system and suitability to Indian conditions.

2. Sewerage System: Generation and estimation of community Sewage, flow variations, storm water flow, types of sewers. Design of sewers and storm water sewers, construction & maintenance of sewers, sewer appurtenances, sewage pumping and pumping stations.

3. House Drainage: Principles of house drainage, traps, sanitary fittings, systems of plumbing, drainage lay out for residences.

4. Characteristics of Sewage: Composition of domestic and industrial sewage, sampling, physical, chemical and microbiological analysis of sewage, biological decomposition of sewage, BOD and BOD kinetics, effluent disposal limits.

5. Treatment of Sewage: Introduction to unit operations and processes - Primary treatment; screening (theory), grit chamber (theory and design), floatation units, sedimentation tanks (theory and design), Secondary treatment units; ASP (theory and design), Sequencing batch reactors (theory and design), Trickling filters (theory and design) Anaerobic systems; Anaerobic filters (theory), UASB (theory), Anaerobic lagoons, Sludge Handling and disposal; thickening, stabilization, dewatering, drying and disposal.

6. Low Cost Sanitation Systems: Imhoff tanks (theory and design), septic tank (theory and design), soakage pit/soil absorption systems; stabilization ponds (theory and design); macrophyte ponds; oxidation ponds (theory and design); and constructed wetland systems.

7. Wastewater Treatment Plants and Advanced Wastewater Treatment: Treatment Plants; site selection, plant design, Hydraulic Profiles, operation and maintenance aspects. Advanced wastewater treatment for nutrient removal, disinfection and polishing.

Books:

1. Waste Water Engg. (Environmental Engg.-II) by B.C.Punmia, Ashok Jain, Laxmi Publications, New Delhi.
2. Environmental Engg. - A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi.
3. "Waste Water Engineering - Treatment and Reuse" by Metcalf & Eddy, TMH, New Delhi.
4. "Environmental Engg." By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
5. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, Delhi.

BTCE -607 ENVIRONMENTAL ENGINEERING LABORATORY

Marks	L	T	P
Internal Marks: 30	0	0	2
External Marks: 20			
Total Marks: 50			

1. To measure the pH value of a water/waste water sample.
2. To determine optimum Alum dose for Coagulation.
3. To find MPN for the bacteriological examination of water.
4. To find the turbidity of a given waste water/water sample
5. To find B.O.D. of a given waste water sample.
6. To measure D.O. of a given sample of water.
7. Determination of Hardness of a given water sample
8. Determination of total solids, dissolved solids, suspended solids of a given water sample.
9. To determine the concentration of sulphates in water/wastewater sample.
10. To find chlorides in a given sample of water/waste water.
11. To find acidity/alkalinity of a given water sample
12. To determine the COD of a wastewater sample.

Books Recommended:

1. Chemistry for Enviromental Engg. and Science by Sawyer & McCarty, TMH, New Delhi
2. Standard Methods for the examination of water & wastewater, APHA, AWWA, WE

BTCE-608 COMPUTER AIDED STRUCTURAL DRAWING - II

Internal Marks:	30	L T P
External Marks:	20	0 0 3
Total Marks: 50		

Structural Drawings of Reinforced Concrete Elements as per BTCE-601

SEVENTH / EIGHTH SEMESTER

BTCE-701 SOFTWARE AND INDUSTRIAL TRAINING

Course	Duration	Internal Marks	External Marks	Total Marks
a) Software Training	Minimum 6 week	150	100	250
b) Industrial Training	Minimum 12 week	300	200	500

***List of Software for Training to be learnt during Training Period**

Any software that enhances professional capability in civil engineering practice a partial indicative list is mentioned below:

1. GT STRUDAL
2. PRIMA VERA
3. GEOTECH
4. ARCVIEW GIS
5. GEO 5
6. GEO STUDIO PROF 2004
7. AUTOCAD CIVIL 3D
8. MX ROAD
9. GEOMATIC
10. STAAD PRO
11. HDM-4
12. PLAXIS
13. Any other relevant software

BTCE 801 Design of Steel Structures – II

Internal Marks: 40 | L T P
External Marks: 60 | 4 1 0
Total Marks: 100

Note: Use of relevant Indian Standards is allowed.

1) Elements of a plate girder, design of a plate girder, curtailment of flanges, various type of stiffeners.
2) Design of steel foot bridge with parallel booms and carrying wooden decking, using welded joints.
3) Complete design of an industrial shed including:
   i) Gantry girder
   ii) Column bracket
   iii) Mill bent with constant moment of inertia
   iv) Lateral and longitudinal bracing for column bent
4) Design of single track railway bridge with lattice girders having parallel chords (for B.G.)
   i) Stringer
   ii) Cross girder
   iii) Main girders with welded joints
   iv) Portal sway bracings
   v) Bearing rocker and rollers

BOOKS & CODES RECOMMENDED:

1) Limit state design of steel structures: **S K Duggal**
2) Design of steel structures: **N Subramanian**
3) Design of steel structures (Vol. 2): **Ram Chandra**
4) Design of steel structures: **L S Negi**
5) Design of steel structures (by limit state method as per IS: 800-2007): **S S Bhavikatti**
6) IS 800: 2007 (General construction in steel-Code of practice)*
7) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*

* permitted in Examination

BTCE 802 DISASTER MANAGEMENT

Internal marks: 40	L T P
External marks: 60	4 0 0
Total marks: 100	

Introduction to Disaster Management: Define and describe disaster, hazard, emergency, vulnerability, risk and disaster management; Identify and describe the types of natural and non-natural disasters. Important phases of Disaster Management Cycle.

Disaster Mitigation and Preparedness: *Natural Hazards*: causes, distribution pattern, consequences and mitigation measures for earth quake, tsunami, cyclone, flood, landslide drought etc. *Man-made hazards*: causes, consequences mitigation measures for various industrial hazards/disasters, Preparedness for natural disasters in urban areas.

Hazard and Risk Assessment: Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems.

Emergency Management Systems (EMS): Emergency medical and essential public health services, response and recovery operations, reconstruction and rehabilitation.

Capacity Building: Gender sensitive disaster management approach and inculcate new skills and sharpen existing skills of government officials, voluntary activists, development of professional and elected representative for effective disaster management, role of media in effective disaster management, overview of disaster management in India, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines..

Application of Geoinformatics and Advanced Techniques: Use of Remote Sensing Systems (RSS) and GIS in disaster Management, role of knowledge based expert systems in hazard scenario, using risks-time charts to plan for the future, early warning systems.

Integration of public policy: Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Case Studies: Lessons and experiences from various important disasters with specific reference to Civil Engineering.

Books/References:

1. Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill.Pub
2. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester
3. Disaster Management, R.B. Singh (Ed), Rawat Publications
4. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction.
5. www.http//ndma,gov,in
6. Disaster Management –Future Challenges & Opportunities by Jagbir Singh, I.K. International Publishing House.

BTCE-803 IRRIGATION ENGINEERING-II

Internal Marks: 40 L T P
External Marks: 60 3 1 0
Total Marks: 100

1. **Head Works**:Types of head works, Functions and investigations of a diversion head work : component parts of a diversion head work and their design considerations, silt control devices.
2. **Theories of Seepage**: Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness.
3. **Design of Weirs**: Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.
4. **Energy Dissipation Devices**: Use of hydraulic jump in energy dissipation, Factors affecting design, Types of energy dissipators and their hydraulic design.
5. **Canal Regulators**: Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.
6. **Canal Falls**: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.
7. **Cross-Drainage works** : Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons and level crossing.
8. **Canal Out-lets** : Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, etc. Details and design of nonmodular, semi-modular and modular outlets.

Books

1. Irrigation Engg. & Hydraulic Structure by Santosh Kumar Garg, Khanna Publishers
2. Design of Irrigation Structures by R.K. Sharma, Oxford IBH Pub
3. Irrigation Engg. and Hydraulics Structures by S.R. Sahasrabudhe, . Katson Publishing
4. Irrigation Practice and Design Vol. I to VII by K.B. Khushlani. Oxford IBH Pub
5. P.N. Modi; Irrigation with Resources and with Power Engineering, Standard Book House
6. Irrigation Engg. Vol. I & II by Ivan E. Houk, John Wiley and sons

BTCE-804 Transportation Engineering – II

Internal Marks: 40 L T P
External Marks: 60 3 1 0
Total Marks: 100

Railway Engineering

1) **Introduction to Railway Engineering**: History of Railways, Development of Indian Railway, Organisation of Indian Railway, Important Statistics of Indian Railways. Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.
2) **Railway Track**: Requirements of a Good Track, Track Specifications on Indian Railways, Detailed Cross-Section of Single/Double Track on Indian Railways. Components of Railway Track: Rails, Sleepers, Ballast, Subgrade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.
3) **Geometric Design of Railway Track**: Alignment, Gradients, Horizontal Curve, Super-elevation, Equilibrium Cant, Cant Deficiency, Transition Curves.
4) **Points and Crossings**: Functions, Working of Turnout, Various types of Track Junctions and their layouts, Level-crossing.
5) **Railway Stations & Yards**: Site Selection, Classification & Layout of Stations, Marshalling Yard, Locomotive Yard, Equipment at Railway Stations & Yards
6) **Signalling and Interlocking**: Objectives, Classification of Signals, Types of Signals in Stations and Yards, Automatic Signalling, Principal of Interlocking.
7) **Modernization of Railway Tracks**: High Speed Tracks, Improvement in existing track for high speed, Ballastless Track, MAGLEV, TACV Track.

Airport Engineering

8) **Introduction to Airport Engineering**: Air Transport Scenario in India and Stages of Development, National and International Organizations.
9) **Airport Planning**: Aircraft Characteristics, Factors for Site Selection, Airport Classification, General Layout of an Airport. Obstructions and Zoning Laws, Imaginary Surfaces, Approach Zones and Turning Zones.
10) **Runway Orientation and Design:** Head Wind, Cross Wind, Wind Rose Diagram, Basic Runway Length, Corrections, Geometric Design Elements, Runway Configuration.
11) **Taxiway and Aircraft Parking**: Aircraft Parking System. Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.
12) **Visual Aids**: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

Books Recommended:

1. Chandra S., and Aggarwal, “Railway Engineering”, M.M. Oxford University Press, New Delhi, 2007.
2. Saxena, S.C., and Arora, S.P., “A Text Book of Railway Engineering”, Dhanpat Rai and Sons, Delhi, 1997.
3. J. S. Mundrey, “Railway Track Engineering”, McGraw Hill Publishing Co., 2009
4. Khanna, S.K., Arora, M.G., and Jain, S.S., “Airport Planning and Design”, Nem Chand & Bros. Roorkee, 1999.
5. Horenjeff, R. and McKelvey, F., “Planning and Design of Airports”, McGraw Hill Company, New York, 1994.
6. Norman J. Ashford, Saleh Mumayiz, Paul H. Wright, “Airport Engineering: Planning, Design and Development of 21st Century”, Wiley Publishers, 2011

BTCE-805 PROJECT

Internal Marks: 100	L T P
External Marks: 50	- - 6
Total Marks: 150	

Students are required to work on project in any of the areas related to Civil Engineering. The students will work 6 hrs per week with his / her supervisor(s).

BTCE-806 DYNAMICS OF STRUCTURES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Overview of structural dynamics: Fundamental objective of structural dynamic analysis - types of prescribed loadings - essential characteristics of a dynamic problem - method of discretization: lumped-mass procedure - generalized displacements - the finite-element concept
Single degree of freedom systems: Components of the basic dynamic system formulation of the equations of motion - direct equilibration using D'Alembert's principle - principle of virtual displacements - *generalized SDOF systems* - rigid body assemblage
Free vibration response: Solution of the equation of motion - undamped free vibrations - damped free vibrations - critical damping - underdamped systems - overdamped systems - negative damping
Response to harmonic loading: Undamped system complementary solution - particular solution - general solution - response ratio - damped system - resonant response
Response to periodic loading: Fourier series expression of the loading - response to the fourier series loading - exponential form of fourier series solution
Response to impulsive loads: General nature of impulsive loads - sine-wave impulse - rectangular impulse - triangular impulse - shock load.
Response to general dynamic loading: Duhamel integral for an undamped system - numerical evaluation of the duhamel integral for an undamped system - response of damped systems - response analysis through the frequency domain
Multi degree of freedom systems: Formulation of the MDOF equations of motion - selection of the degrees of freedom - orthogonality conditions - normal co-ordinates - uncoupled equations of motion - undamped & damped - mode superposition procedure
Continuous parameter systems: Vibration analysis by Rayleigh's method - basis of the method - approximate analysis of a general system - selection of the vibration shape - improved Rayleigh method
Practical vibration analysis: Preliminary comments - stodola method - fundamental mode analysis – proof of convergence - analysis of second mode - analysis of third and higher modes – analysis of highest mode - Rayleigh's method in discrete co-ordinate systems.

Books:

1. Clouch R.W. & Penzien J., Dynamics of Structures, McGraw Hill
2. Weaver W., Jr. Timoshenko S.P., Young D.H, Vibration Problem in Engineering, John Wiley
3. Meivovitch L., Elements of Vibration Analysis, McGraw Hill
4. Seto W.W., Mechanical Vibrations, Schaum's Outline Series, McGraw Hill
5. Srinivasan P., Mechanical Vibration Analysis, Tata McGraw Hill
6. A K Chopra; Dymanics of Structures; Prentice-Hall
7. Earthquake Resistant Design of Structures; Pankaj Agrawal, Manish Shrikhande; Prentice Hall of India

BTCE-807 FINITE ELEMENT METHODS

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	**100**	

Introduction: the finite element method - the element characteristic matrix - element assembly and solution for unknowns - summary of finite element history - basic equations of elasticity – strain displacement relations - theory of stress and deformation - stress-strain-temperature relations

The direct stiffness method: structure stiffness equations - properties of [K] - solution of unknowns - element stiffness equations - assembly of elements - node numbering to exploit matrix sparsity - displacement boundary conditions - gauss elimination solution of equations - conservation of computer storage - computational efficiency - stress computation - support reactions - summary of the finite element procedure

Stationary principles, Rayleigh-Ritz and interpolation: principle of stationary potential energy - problems having many d.o.f - potential energy of an elastic body - the Rayleigh-Ritz method - piecewise polynomial field - finite element form of Rayleigh-Ritz method - finite element formulations derived from a functional - interpolation - shape functions for C^0 and C^1 elements - lagrangian interpolation functions for two and three dimensional elements

Displacement based elements for structural mechanics: formulae for element stiffness matrix and load vector - overview of element stiffness matrices - consistent element nodal vector - equilibrium and compatibility in the solution - convergence requirements - patch test - stress calculation - other formulation methods

Straight sided triangles and tetrahedral: natural coordinates for lines - triangles and tetrahedral - interpolation fields for plane triangles - linear and quadratic triangle - quadratic tetrahedron

The isoparametric formulation: introduction - an isoparametric bar element - plane bilinear element - summary of gauss quadrature - quadratic plane elements - direct construction of shape functions for transition elements - hexahedral (solid) isoparametric elements - triangular isoparametric elements - consistent element nodal loads - validity of isoparametric elements - appropriate order of quadrature - element and mesh instabilities - remarks on stress computation

Coordinate transformation: transformation of vectors - transformation of stress, strain and material properties - transformation of stiffness matrices - transformation of flexibility to stiffness - inclined support - joining dissimilar elements to one another- rigid links - rigid elements

Bending flat plates: plate bending theory - finite elements for plates - triangular discrete Kirchoff element - boundary conditions

Introduction to weighted residual method: some weighted residual methods - galerkin finite element method - integration by parts - axially loaded bar - beam - plane elasticity

Reference books

1. Desai C.S., *Elementary Finite Element Method*, Prentice Hall of India
2. Chandrupatla T.R. & Belegundu A.D., *Introduction to Finite Elements in Engineering*, Prentice Hall of India
3. Bathe K.J., *Finite Element Procedures in Engineering Analysis*, Prentice Hall of India

4. Gallaghar R.H., *Finite Element Analysis: Fundamentals,* Prentice Hall Inc.
5. Rajasekaran S., *Finite Element Analysis in Engineering Design*, Wheeler Pub.
6. Krishnamoorthy C. S., *Finite Element Analysis - Theory and Programming,* Tata McGraw Hill
7. Zienkiewics O.C. & Taylor R.L., *The Finite Element Method,* Vol I & II, McGraw Hill

BTCE-808 ADVANCED REINFORCED CONCRETE DESIGN

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: No Indian Codes of Practice and Design handbooks are permitted, so paper setter is expected to provide required data from relevant IS codes, for any numerical or design part.

Large span concrete roofs – Classification- Behaviour of Flat slabs- Direct design and equivalent frame method- Codal provisions
Forms of Shells and Folded plates- Structural behaviour of cylindrical shell and folded plate- Method of analysis-beam action, arch action and membrane analysis- Codal provisions- Design of simply supported circular cylindrical long shells and folded plates.

Yield line analysis of slabs- virtual work and equilibrium method of analysis- simply supported rectangular slabs with corners held down- uniform and concentrated loads- design of simply supported rectangular and circular slabs

Analysis of deep beams- Design as per IS 456-2000
Analysis of stresses in concrete chimneys- uncracked and cracked sections- Codal provisions- Design of chimney

Retaining walls -Analysis and Design of cantilever and counterfort retaining walls with horizontal and inclined surcharge.

Overhead water tanks- rectangular and circular with flat bottom- spherical and conical tank roofs- staging- Design based on IS 3370

Reference books

1. Reinforced Concrete Structural Elements- Purushothaman. P, Tata Mc Graw Hill
2. Design and Construction of Concrete Shell Roofs- G.S.Ramaswamy
3. Reinforced Concrete – Ashok K Jain, Nem Chand Bros. Roorkee
4. Plain and Reinforced Concrete – Jain & Jaikrishna, Vol. I & II, Nem Chand Bros. Roorkee
5. Reinforced Concrete Chimneys- Taylor C Pere,
6. Yield Line Analysis of Slabs- Jones L L, Thomas and Hudson
7. Design of deep girders, Concrete Association of India
8. Reinforced Concrete, Mallick & Gupta- Oxford & IBH
9. IS 456-2000
10. IS2210-1998- Criteria for design of reinforced concrete shell structures and folded plates
11. IS 4998-1998- Criteria for design of reinforced concrete chimneys
12. IS 3370- 1991- Part 1-4- Code of Practice for concrete structures for the storage of liquids

BTCE – 809 PRESTRESSED CONCRETE

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: IS 1343 is permitted in examination.

Materials for prestressed concrete and prestressing systems
High strength concrete and high tensile steel – tensioning devices – pretensioning systems – post tensioning systems.

Analysis of prestress and bending stresses
Analysis of prestress – resultant stresses at a sector – pressure line or thrust line and internal resisting couple – concept of load balancing – losses of prestress – deflection of beams.

Strength of prestressed concrete sections in flexure, shear and torsion
Types of flexural failure – strain compatibility method – IS:1343 code procedure – design for limit state of shear and torsion.

Design of prestressed concrete beams and slabs
Transfer of prestress in pre tensioned and post tensioned members – design of anchorage zone reinforcement – design of simple beams – cable profiles – design of slabs.

Books

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill
2. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
3. P. Dayaratnam, Prestressed Concrete, Oxford & IBH
4. R. Rajagopalan, Prestressed Concrete.
5. IS 1343 2012 **Code of Practice for Prestressed Concrete**

BTCE-810 GROUND IMPROVEMENT TECHNIQUES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction to soil improvement without the addition of materials - dynamic compaction equipment used - application to granular soils - cohesive soils - depth of improvement - environmental considerations - induced settlements - compaction using vibratory probes - vibro techniques vibro equipment - the vibro compaction and replacement process - control of verification of vibro techniques - vibro systems and liquefaction - soil improvement by thermal treatment - preloading techniques - surface compaction introduction to bio technical stabilization

Introduction to soil improvement with the addition of materials - lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils - settlement of lime treated soils - improvement in slope stability - control methods - chemical grouting - commonly used chemicals - grouting systems - grouting operations - applications - compaction grouting - introduction - application and limitations - plant for preparing grouting materials - jet grouting - jet grouting process - geometry and properties of treated soils - applications - slab jacking - gravel - sand - stone columns

Soil improvement using reinforcing elements - introduction to reinforced earth - load transfer mechanism and strength development - soil types and reinforced earth - anchored earth nailing reticulated micro piles - soil dowels - soil anchors - reinforced earth retaining walls

Geotextiles - Behaviour of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability - design aspects - slopes - clay embankments - retaining walls – pavements

<u>Reference books</u>

1. Moseley, *Text Book on Ground Improvement*, Blackie Academic Professional, Chapman & Hall
2. Boweven R., *Text Book on Grouting in Engineering Practice*, Applied Science Publishers Ltd
3. Jewell R.A., *Text Book on Soil Reinforcement with Geotextiles*, CIRIA Special Publication, Thomas Telford
4. Van Impe W.E., *Text Book On Soil Improvement Technique & Their Evolution*, Balkema Publishers
5. Donald .H. Gray & Robbin B. Sotir, *Text Book On Bio Technical & Soil Engineering Slope Stabilization*, John Wiley
6. Rao G.V. & Rao G.V.S., *Text Book On Engineering With Geotextiles*, Tata McGraw Hill
7. Korener, *Construction & Geotechnical Methods In Foundation Engineering*, McGraw Hill
8. Shukla, S.K. and Yin, J.H. Fundamental of Geosynthetic Engineering, Taylor & Francis
9. Swamisaran, Reinforced Soil and its Engineering Application, New Age Publication
10. Gulati, S.K. and Datta, M., Geotechnical Engineering, TMH

BTCE-811 SOIL DYNAMICS & MACHINE FOUNDATION

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	**100**	

Introduction - nature of dynamic loads - stress conditions on soil elements under earthquake loading - dynamic loads imposed by simple crank mechanism - type of machine foundations - special considerations for design of machine foundations - theory of vibration: general definitions - properties of harmonic motion - free vibrations of a mass-spring system - free vibrations with viscous damping - forced vibrations with viscous damping - frequency dependent exciting force - systems under transient forces - Raleigh's method - logarithmic decrement - determination of viscous damping - principle of vibration measuring instruments - systems with two degrees of freedom - special response

Criteria for a satisfactory machine foundation - permissible amplitude of vibration for different type of machines - methods of analysis of machine foundations - methods based on linear elastic weightless springs - methods based on linear theory of elasticity (elastic half space theory) - methods based on semi graphical approach - degrees of freedom of a block foundation - definition of soil spring constants - nature of damping - geometric and internal damping - determination of soil constants - methods of determination of soil constants in laboratory and field based on IS code provisions

Vertical, sliding, rocking and yawing vibrations of a block foundation - simultaneous rocking, sliding and vertical vibrations of a block foundation - foundation of reciprocating machines - design criteria - calculation of induced forces and moments - multi-cylinder engines - numerical example (IS code method)

Foundations subjected to impact loads - design criteria - analysis of vertical vibrations - computation of dynamic forces - design of hammer foundations (IS code method) - vibration isolation - active and passive isolation - transmissibility - methods of isolation in machine foundations
Note: Use of I.S 2974 Part I and II will be allowed in the university examination

Reference books

1. Shamsher Prakash, *Soil Dynamics*, McGraw Hill
2. Das and Ramana, Principle of Soil Dynamica, Cengage Learning
3. Alexander Major, *Dynamics in Soil Engineering*
4. Sreenivasalu & Varadarajan, *Handbook of Machine Foundations*, Tata McGraw Hill
5. IS 2974 - Part I and II, *Design Considerations for Machine Foundations* *
6. IS 5249: *Method of Test for Determination of Dynamic Properties Of Soils*

* IS code marked with * is permitted in examination.

BTCE-812 EARTH AND EARTH RETAINING STRUCTURES

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Earthen Dam

Introduction to Earthen dams, types of dams, selection of type of dam based on material availability, foundation conditions and topography

Design details – crest, free board, upstream and down stream slopes, upstream and down stream slope protection – central and inclined cores – types and design of filters

Seepage analysis and control – seepage through dam and foundations – control of seepage in earth dam and foundation

Stability analysis – critical stability conditions – evaluation of stability by Bishop's and sliding wedge methods under critical conditions

Construction techniques – methods of construction – quality control

Instrumentation – measurement of pore pressures

Earth pressure theories – Rankine's and Coulomb's earth pressure theories for cohesionless and cohesive backfills – computation of earth pressures for various cases – inclined – with surcharge – submerged and partly submerged – stratified backfills

Rigid retaining structures – active and passive earth pressures against gravity retaining walls – computation of earth pressures by Trial wedge method – a mathematical approach for completely submerged and partly submerged backfills – Perched water table – importance of capability tension in earth pressure.

Graphical methods of earth pressure computation – trial wedge method for coulomb's and Rankine's conditions, for regular and irregular ground and wall conditions – Rebhan's construction for active pressure – friction circle method – logarithmic spiral method.

Design of gravity retaining wall – cantilever retaining walls

Flexible retaining structure – type and methods of construction – design strength parameters – safety factor for sheet pile walls – computation of earth pressures against cantilever sheet piles in cohesionless and cohesive soils – anchored sheet piles – free earth method – fixed earth method – Rowe's moment reduction method – stability of sheet piling

Diaphragm walls and coffer dams – type of diaphragm walls and their construction techniques in various soil types – earth pressure on braced cuts and coffer dams – design of coffer dams

Reference books

1. Huntington, Earth pressure on retaining walls.
2. Bowles, Foundation Analysis and Design.
3. Jones, Earth Reinforcements & Soil structures.
4. Prakash, Ranjan & Sasan, Analysis & Design of Foundation & Retaining Structures.

BTCE-813 REINFORCED EARTH AND GEOTEXTILES

Internal Marks :	40	L T P
External Marks :	60	3 1 0

Total Marks : 100

Reinforced Earth – The mechanisms of the reinforced earth techniques – Design principles – Materials used for construction – Advantages of reinforced earth – Reinforced earth construction with GI sheets and strips

An overview of Geosynthetics, Description of Geotextiles – Geogrids – Geonets – Geomembranes – Geocomposites – Geocells – Designing with Geotextiles – Geotextile properties and test methods – Functions of Geotextile – Design methods for separation – stabilization – filtration – Drainage, Soil anchors.

Designing with Geogrids – Geogrid properties and test methods – Designing with Geonets – Geonet properties and test methods – Designing with Geomembranes – Geomembrane properties and test methods – construction practices with Geotextiles, Geogrids, Geonets, Geomembranes

Design of liquid Contaminant liners – liquid contaminant liners – Covers for reservoirs- Water conveyance (Canal liners)-- solid material liners – underground storage tanks – Design of pavements Geo composites as liquid / Vapour Barriers –Improvement in bearing capacity – Erosion Control for waterways.

Reference books

1. Robert M. Koerner, *Designing with Geosynthetics*, Prentice Hall – 1989
2. G.V Rao & GVS Suryanarayana Raju, *Engineering with Geosynthetics*, Tata Mc Graw Hill Publishing Co. New Delhi
3. Korener, *Construction & Geotechnical Methods In Foundation Engineering*, McGraw Hill
4. Shukla, S.K. and Yin, J.H. Fundamental of Geosynthetic Engineering, Taylor & Francis
5. Swamisaran, Reinforced Soil and its Engineering Application, New Age Publication
6. Gulati, S.K. and Datta, M., Geotechnical Engineering, TMH

BTCE-814 ENVIRONMENTAL IMPACT ASSESSMENT

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	**100**	

Concepts of environmental impact analysis - key features of the National Environmental Policy Act and its implementation, screening in the EIA process, role of the USEPA, environmental protection and EIA at the national level, utility and scope of the EIA process
Planning and management of environmental impact studies
Environmental impact - factors for consideration in assessing the impacts of water related projects, power projects, waste water treatment facilities etc .
Concepts and terms in the impact assessment process, Socioeconomic impact analysis.

Simple methods for impact identification – matrices, net works and checklists.
Description of the environmental setting
Environmental indices and indicators for describing the affected environment.

Prediction and assessment- Prediction and assessment of the impact on surface water, soil, groundwater, air, water quality, vegetation and wild life and biological environments. Case studies and examples.
Prediction and assessment of visual impacts and impacts on the socio-economic setting, decision methods for evaluation of alternatives, public participation in decision-making
Preparing the EIA document
Environmental monitoring.

Reference books

1. Larry W Canter, Environmental Impact Assessment, McGraw Hill, Inc., 1996
2. Betty Bowers Marriot, Environmental Impact Assessment A Practical Guide, McGraw Hill, Inc., 1997.
3. C.J. Barrow, Environmental & Social Impact Assessment – An Introduction, Edward Arnold, 2002.
4. Evan. K. Paleologos and Ian Lerche,Environmental Risk Analysis, McGraw Hill Inc., 2001
5. Peter Morris (ed.) and Riki Therivel (ed.), Methods of Environmental Impact Assessment, Routledge, 2001.

BTCE 815 ADVANCED ENVIRONMENTAL ENGG.

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

INTRODUCTION

Environment, Biosphere, Ecosystems; their interrelationships and pollution.

AIR POLLUTION & CONTROL

Air pollution, Physical & chemical fundamentals, Air pollution standards, Effects of air pollution; climate change, Air pollution meteorology, Atmospheric dispersion of pollutants, Indoor air quality models, Air pollution control of stationary & mobile sources.

NOISE POLLUTION & CONTROL:

Introduction, Rating Systems, Sources & Criteria, Noise prediction and Control

SOLID WASTE MANAGEMENT:

Perspectives & properties, collection, transfer & transport, Life cycle assessment, Disposal in a landfill, Waste to energy, Composting, Resource conservation & recovery for sustainability

HAZARDOUS WASTE MANAGEMENT:

The hazard, risk, definition & classification RCRA &HSWA, CERCLA & SARA, Hazardous waste management, Treatment technologies,

Land disposal, Groundwater contamination & remediation

.

BOOKS:

1..Davis & Cornwell, Environmental Engineering, Mc Graw Hill Int Ed

2..Peavy, H.S, Rowe, D.R, Tchobanoglous, G, Environmental Engineering, Mc Graw Hill

3..E.P. Odum, Fundamentals of Ecology, Oxford and IBH Pub.

4. Vesilind, Worrell and Reinhart, Solid Waste Engineering, Cengage Learning India

5. Rao and Rao, Air Pollution, Tata McGraw Hill Pub

BTCE 816 FLOOD CONTROL & RIVER ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction:

River Engineering, Flood forecasting, Flood Estimation, Estimating Design flood, Empirical formulate, statistical or Probability methods, Unit hydrograph method

Flood control and Economics of Flood control

River Regime theories, River Modeling, Meandering

River Training, Channel improvements; cut offs, River control structures

Sediment load, Resistance to flow,

Social and environmental impacts.

BOOKS:

1.R.J. Garde, K.G. Ranga Raju, 1. Mechanics of Sedement Transportation and Alluvial Stream problems, Wiley Eastern Ltd.
2. V.A. Vanoni , Sedimentation Engg, John Wiley and Sons
3. .A. Raudkivi, Loose Boundary Hydraulics, Pergamon Press, Inc
4. P.N. Modi, Irrigation Water Resources and Water Power Engineering, Standard Book House
5. Manual on rivers, their behaviour and Training, Pub No. 60, CBIP, New Delhi

BTCE - 817 HYDROLOGY AND DAMS

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

1) Introduction, Precipitation: Importance of hydrological data in water resources planning. The hydrologic cycle. Mechanics of precipitation, types and causes, measurement by rain gauges, Gauge net-works, hyetograph, averaging depth of precipitation over the basin, mass-rainfall curves, intensity duration frequency curves, depth area-duration curves.
2)
   a) Interception, Evapo-transptration and Infiltration: Factors affecting interception, evaporation from free water surfaces and from land surfaces, transpiration, Evapo-transpiration.
   b) Infiltration Factors affecting infiltration, rate, Infiltration capacity and its determination.
3) Runoff: Factors affecting runoff, run-off hydrograph, unit hydrograph theory, S-curve hydrograph, Synder's synthetic unit hydrograph.
4) Peak Flows: Estimation of Peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph.
5) Gravity Dams-Non Overflow Section: Forces acting, Stability factors, stresses on the faces of dam, Design of profile by the method of zoning, elementary profile of a dam.
6) Gravity Dams-Spillways: Creagers profiles neglecting velocity of approach, profile taking velocity of approach into account, Upstream lip and approach ramp, Advantages of gated spillways, Discharge characteristics of spillways.
7) Arch and Buttress Dams: Classification of arch dam- constant radius, constant angle and variable radius , Cylinder theory, Expression relating central angle and Cross-Sectional area of arch. Types of buttress dams, Advantages of buttress dams.
8) Earth Dams: Components of earth dams and their functions, Phreatic line determination by analytical and graphical methods.

REFERENCE

1. Engineering Hydrology - J.Nemec, Prentice Hall
2. Engineering Hydrology by Stanley Buttler, John. Wiley
3. Ground Water Hydrology by TODD, John. Wiley
4. Engineering for Dams Vol. II & III by Creager Justin & Hinds. John. Wiley
5. Hydrology by. S.K.Garg, Khanna Pub
6. Hydrology Principles, Analysis and Design by. Raghunath, H M, New Age Int. Pub

BTCE-818 PAVEMENT DESIGN

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Note: Use of IRC:37-2012 and IRC:58-2011 shall be allowed in the examination.

1. **Introduction:** Types of pavement structure. Functions of pavement components, Factors affecting pavement design, Design wheel load, Strength characteristics of pavement materials. Comparison of flexible and rigid pavements.

2. **Design of Flexible Pavements:** General design considerations, Methods for design of flexible pavements – Group Index Method, Triaxial Test Method, Hveem Stabilometer Method, McLeod’s Method, Indian Roads Congress Method.

3. **Design of Bituminous Mixes:** Mix Design Approaches, Marshall Method of Bituminous Mix Design, Superpave

4. **Design of Rigid Pavements:** General design considerations, Westergard's Analysis, Methods for design of rigid pavements - PCA method, AASHTO Method, Indian Roads Congress Method, Types and design of Joints in cement concrete pavements.

5. **Modern Design Concepts:** Reinforced Concrete Pavement, Airport Pavement Design, Bituminous Pavement with Cemented Base, Interlocking Concrete Block Pavement, Full Depth Bituminous Pavement, Ultrathin White Topping, Perpetual Pavement, Pavement Overlays.

Books Recommended:

1. Yoder, E. J., and M. W. Witczak, “Principals of Pavement Design”, Wiley Publication.
2. Khanna, S. K., and C. E. G. Justo, “Highway Engineering”, Nem Chand & Bros., Roorkee.
3. Sharma, S. K., “Principles, Practice and Design of Highway Engineering”, S. Chand & Co.
4. Chakraborty,P. and A.Das, “Principles of Transportation Engineering”, Prentice Hall India.
5. Yang H. Huang, “Pavement Analysis and Design”, Prentice Hall.

BTCE-819 TRAFFIC ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

1. **Introduction:** Elements of Traffic Engineering, Components of traffic system – road users, vehicles, highways and control devices.

2. **Vehicle Characteristics**: IRC standards, Design speed, volume, Highway capacity and levels of service, capacity of urban and rural roads, PCU concept and its limitations.

3. **Traffic Stream Characteristics**: Traffic stream parameters, characteristics of interrupted and uninterrupted flows.

4. **Traffic Studies**: Traffic volume studies, origin destination studies, speed studies, travel time and delay studies, parking studies, accident studies.

5. **Traffic Regulation and Control:** Signs and markings, Traffic System Management, At-grade intersections, Channelisation, Roundabouts.

6. **Traffic Signals:** Pre-timed and traffic actuated. Design of signal setting, phase diagrams, timing diagram, Signal co-ordination.

7. **Grade Separated Intersections**: Geometric elements for divided and access controlled highways and expressways.

8. **Traffic Safety**: Principles and practices, Road safety audit.

9. **Intelligent Transportation System:** Applications in Traffic Engineering

Books Recommended:

1. William, R.M. and Roger, P.R., "Traffic Engineering", Prentice Hall.
2. Hobbs, F.D., "Traffic Planning and Engineering", Pergamon Press.
3. Khisty, C.J. and Kent, B.L., "Transportation Engineering – An Introduction", Prentice Hall of India Pvt. Ltd.
4. Kadiyali, L.R., "Traffic Engineering & Transport Planning", Khanna Publishers, New Delhi.
5. Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, New Delhi.

BTCE-820 BRIDGE ENGINEERING

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

1. **Introduction:** Definition and components of a bridge, Classification of bridges, Choice of a bridge type.

2. **Investigation for Bridges:** Need for investigation, Selection of bridge site, Determination of design discharge for River Bridge, Linear waterway, Economical span, Vertical clearance, Scour depth, Afflux, Traffic projection.

3. **Standard Specifications for Road Bridges:** IRC Bridge Codes, Width of carriageway, Clearances, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic force.

4. **Reinforced Concrete Bridges:** Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Pre-stressed concrete bridges.

5. **Steel Bridges:** Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.

6. **Sub-structure and Foundation:** Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.

7. **Bearings, Joints & Appurtenances:** Importance of Bearings, Different types of bearings-Expansion Bearings, Fixed Bearings, Elastomeric Bearings, Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails.

8. **Construction and Maintenance of Bridges:** Methods of construction of concrete and steel bridges. Formwork and falsework for concrete bridges, Causes of Bridge failures, Inspection and maintenance.

Books Recommended:

1. Johnson, Victor, “Essentials of Bridge Engineering”, Oxford University Press.
2. Khadilkar, C. H., “A Text book of Bridge Construction”, Allied Publishers.
3. Rangwala, S. C., “Bridge Engineering”, Charotar Publishing House Pvt. Ltd.
4. Raina, V. K., “Concrete Bridges Handbook”, Shroff Publishers and Distributors.
5. Ponnuswamy, S. “Bridge Engineering”, McGraw Hill Education.

BTCE-821 INFRASTRUCTURE DEVELOPMENT & MANAGEMENT

Internal Marks :	40	L T P
External Marks :	60	3 1 0
Total Marks :	100	

Introduction: Impact of Infrastructure development on economic development, standard of living and environment. Reasons for rise of public sector and government in infrastructural activities. Changed socio-economic scenario and current problems and related issues.

Policies on Infrastructure Development: A historical review of the Government policies on infrastructure. Current public policies on transportations, power and telecom sectors. Plans for infrastructure development. Legal framework for regulating private participation in roads and highways, Ports & Airports, Power and Telecom.

Construction and Infrastructure: Construction component of various infrastructure sectors. Highway, ports and aviation, oil and gas, power, telecom, railways, irrigation. Current scenario, future needs, investment needed, regulatory framework, government policies and future plans. Technological and methodological demands on construction management in infrastructure development projects.

Infrastructure Management: Importance, scope and role in different sectors of construction.

- **Highway Sector:** Repayment of Funds, Toll Collection Strategy, Shadow tolling, and direct tolls, Maintenance strategy, Review of toll rates & structuring to suit the traffic demand,
- **Irrigation Projects:** Large / Small Dams - Instrumentation, monitoring of water levels, catchments area, rainfall data management, prediction, land irrigation planning & policies, processes Barrages, Canals.
- **Power Projects:** Power scenario in India, Estimated requirement, Generation of Power distribution strategies, national grid, load calculation & factors, Hydropower - day to day operations, management structures, maintenance, Thermal Power, Nuclear Power.
- **Airports:** Requisites of domestic & International airports & cargo & military airports, facilities available, Terminal management, ATC.
- **Railways:** Mass Rapid Transport System MRTS, LRT, Multi-modal Transport System.

Books Recommended:

1. Chandra, Prassanna, “Projects, Planning, Analysis, Selection, Financing, Implementation and Review”, Tata McGraw-Hill, New Delhi, 2006.
2. Raghuram, G. & Jain, R., “Infrastructure Development & Financing Towards a Public-Private Partnership”, Macmillan India Ltd., New Delhi, 2002.
3. India Infrastructure Report 2001 & 2002, Oxford University Press, New Delhi, 2001/02.
4. NICMAR, “Construction Business Opportunities in Infrastructure Development in India”, NICMAR, Mumbai, 2001.
5. Parikh Kirit S., “India Development Report, 1999-2000”, Oxford University Press, New Delhi, 2002.
6. GOI Rakesh Mohan Committee, “The India Infrastructure Report”, National Council of Applied Economic Research, New Delhi, 1996.

Study Scheme & Syllabus of

Bachelor of Technology

(1st and 2nd semester)

Batch 2018 onwards

By

Department of Academics

IK Gujral Punjab Technical University

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IKGPTU CAMPUS HOSHIARPUR

Bachelors of Technology 1st and 2nd semester
It is an Under Graduate (UG) Programme of 4 years duration (8 semesters)
Eligibility for Admission: *As per AICTE norms.*

First Semester **Group-A** **Contact Hrs. : 24**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTPHXX-18	Basic Science Course	Physics	3	1	0	40	60	100	4
BTPHXX-18	Basic Science Course	Physics (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-I	3*	1	0	40	60	100	4
BTEE101-18	Engineering Science Course	Basic Electrical Engineering	3	1	0	40	60	100	4
BTEE102-18	Engineering Science Course	Basic Electrical Engineering (Lab)	0	0	2	30	20	50	1
BTME101-18	Engineering Science Courses	Engineering Graphics & Design	1	0	4	60	40	100	3
BMPD101-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
TOTAL			**10**	**3**	**11**	**220**	**280**	**500**	**17.5**

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

First Semester **Group-B** **Contact Hrs. : 29**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCH101-18	Basic Science Course	Chemistry-I	3	1	0	40	60	100	4
BTCH102-18	Basic Science Course	Chemistry-I (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-I	3*	1	0	40	60	100	4
BTPS101-18	Engineering Science Course	Programming for Problem Solving	3	0	0	40	60	100	3
BTPS102-18	Engineering Science Course	Programming for Problem Solving (Lab)	0	0	4	30	20	50	2
BTMP101-18	Engineering Science Courses	Workshop / Manufacturing Practices	1	0	4	60	40	100	3
BTHU101-18	Humanities and Social Sciences including Management courses	English	2	0	0	40	60	100	2
BTHU102-18	Humanities and Social Sciences including Management courses	English (Lab)	0	0	2	30	20	50	1
BMPD101-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
	TOTAL		**12**	**2**	**15**	**290**	**360**	**650**	**20.5**

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

Second Semester **Group-A** **Contact Hrs. : 29**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCH101-18	Basic Science Course	Chemistry-I	3	1	0	40	60	100	4
BTCH102-18	Basic Science Course	Chemistry-I (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-II	3*	1	0	40	60	100	4
BTPS101-18	Engineering Science Course	Programming for Problem Solving	3	0	0	40	60	100	3
BTPS102-18	Engineering Science Course	Programming for Problem Solving (Lab)	0	0	4	30	20	50	2
BTMP101-18	Engineering Science Courses	Workshop / Manufacturing Practices	1	0	4	60	40	100	3
BTHU101-18	Humanities and Social Sciences including Management courses	English	2	0	0	40	60	100	2
BTHU102-18	Humanities and Social Sciences including Management courses	English (Lab)	0	0	2	30	20	50	1
BMPD201-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
	TOTAL		**12**	**2**	**15**	**290**	**360**	**650**	**20.5**

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

Second Semester **Group-B** **Contact Hrs.: 24**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTPHXX-18	Basic Science Course	Physics	3	1	0	40	60	100	4
BTPHXX-18	Basic Science Course	Physics (Lab)	0	0	3	30	20	50	1.5
BTAMXX-18	Basic Science Course	Maths-II	3*	1	0	40	60	100	4
BTEE101-18	Engineering Science Course	Basic Electrical Engineering	3	1	0	40	60	100	4
BTEE102-18	Engineering Science Course	Basic Electrical Engineering (Lab)	0	0	2	30	20	50	1
BTME101-18	Engineering Science Courses	Engineering Graphics & Design	1	0	4	60	40	100	3
BMPD201-18		Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
	TOTAL		**10**	**3**	**11**	**220**	**280**	**500**	**17.5**

***These are the minimum contact hrs. allocated. The contact hrs. may be increased by institute as per the need based on the content of subject.**

Note : 1. Mentoring and Professional Development will be offered as mandatory Non-Credit course. Mentoring and Professional Development course will have internal evaluation only.

2. This study scheme & syllabus is not applicable for B. Tech Chemical Engineering and B. Tech Petrochem & Petroleum Refinery Engineering. The study scheme and syllabus of B. Tech Chemical Engineering and B. Tech Petrochem & Petroleum Refinery Engineering is separately uploaded on University website.

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3. There will be no external theory exam for subject code BTME101-18 (Engineering Graphics & Design) For detail evaluation scheme refer detailed syllabus (page no. 84)
4. The Institutional Summer Vacation Training (4 Weeks) as per IKGPTU/DA/792 dated 21.05.2019.

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 credit
1 Hr. Tutorial (T) per week	1 credit
1 Hr. Practical (P) per week 2 Hours Practical(Lab)/week	0.5 credits 1 credit

B. Range of credits –

A range of credits from 150 to 160 for a student to be eligible to get Under Graduate degree in Engineering. A student will be eligible to get Under Graduate degree with Honours or additional Minor Engineering, if he/she completes an additional 20 credits. These could be acquired through MOOCs.

C. Structure of Undergraduate Engineering program:

S. No.	Category	Suggested Breakup of Credits(Total 160)
1	Humanities and Social Sciences including Management courses	12
2	Basic Science courses	25
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	24
4	Professional core courses	48
5	Professional Elective courses relevant to chosen specialization/branch	18
6	Open subjects – Electives from other technical and /or emerging subjects	18
7	Project work, seminar and internship in industry or elsewhere	15
8	Mandatory Courses [Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge]	(non-credit)
	Total	160

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

Induction Programs

A Guide to Induction Program

Introduction

(Induction Program was discussed and approved for all colleges by AICTE in March 2017. It was discussed and accepted by the Council of IITs for all IITs in August 2016. It was originally proposed by a Committee of IIT Directors and accepted at the meeting of all IIT Directors in March 2016.[1] *This guide has been prepared based on the Report of the Committee of IIT Directors and the experience gained through its pilot implementation in July 2016 as accepted by the Council of IITs. Purpose of this document is to help insti-tutions in understanding the spirit of the accepted Induction Program and implementing it.)*

Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond.

The graduating student must have knowledge and skills in the area of his study. However, he must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he would understand and fulfill his responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.

There is a mad rush for engineering today, without the student determining for himself his interests and his goals. This is a major factor in the current state of demotivation towards studies that exists among UG students.

The success of gaining admission into a desired institution but failure in getting the desired branch, with peer pressure generating its own problems, leads to a peer envi-ronment that is demotivating and corrosive. Start of hostel life without close parental supervision at the same time, further worsens it with also a poor daily routine.

To come out of this situation, a multi-pronged approach is needed. One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them

[1]A Committee of IIT Directors was setup in the 152nd Meeting of IIT Directors on 6th September 2015 at IIT Patna, on how to motivate undergraduate students at IITs towards studies, and to develop verbal ability. The Committee submitted its report on 19th January 2016. It was considered at the 153rd Meeting of all IIT Directors at IIT Mandi on 26 March 2016, and the accepted report came out on 31 March 2016. The Induction Program was an important recommendation, and its pilot was implemented by three IITs, namely, IIT(BHU), IIT Mandi and IIT Patna in July 2016. At the 50th meeting of the Council of IITs on 23 August 2016, recommendation on the Induction Program and the report of its pilot implementation were discussed and the program was accepted for all IITs.

work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character.

Induction Program

When new students enter an institution, they come with diverse thoughts, backgrounds and preparations. It is important to help them adjust to the new environment and inculcate in them the ethos of the institution with a sense of larger purpose. Precious little is done by most of the institutions, except for an orientation program lasting a couple of days.

We propose a 3-week long induction program for the UG students entering the insti-tution, right at the start. Normal classes start only after the induction program is over. Its purpose is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awarness, sensitivity and understanding of the self, people around them, society at large, and nature.[2]

The time during the Induction Program is also used to rectify some critical lacunas, for example, English background, for those students who have deficiency in it.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

Induction Program as described here borrows from three programs running earlier at diff erent insti-tutions: (1) Foundation Program running at IIT Gadhinagar since July 2011, (2) Human Values course running at IIIT Hyderabad since July 2005, and (3) Counselling Service or mentorship running at several IITs for many decades. Contribution of each one is described next.

(1) IIT Gandhinagar was the first IIT to recognize and implement a special 5-week Foundation Program for the incoming 1st year UG students. It took a bold step that the normal classes would start only after the five week period. It involved activities such as games, art, etc., and also science and other creative workshops and lectures by resource persons from outside.

(2) IIIT Hyderabad was the first one to implement a compulsary course on Human Values. Under it, classes were held by faculty through discussions in small groups of students, rather than in lecture mode. Moreover, faculty from all departments got involved in conducting the group discussions under the course. The content is non-sectarian, and the mode is dialogical rather than sermonising or lecturing. Faculty were trained beforehand, to conduct these discussions and to guide students on issues of life.

(3) Counselling at some of the IITs involves setting up mentor-mentee network under which 1st year students would be divided into small groups, each assigned a senior student as a student guide, and a faculty member as a mentor. Thus, a new student gets connected to a faculty member as well as a senior student, to whom he/she could go to in case of any difficulty whether psychological, financial, academic, or otherwise.

The Induction Program defined here amalgamates all the three into an integrated whole, which leads to its high eff ectiveness in terms of building physical activity, creativity, bonding, and character. It develops sensitivity towards self and one's relationships, builds awareness about others and society beyond the individual, and also in bonding with their own batch-mates and a senior student besides a faculty member.

Scaling up the above amalgamation to an intake batch of 1000 plus students was done at IIT(BHU), Varanasi starting from July 2016.

2.1 Physical Activity

This would involve a daily routine of physical activity with games and sports. It would start with all students coming to the field at 6 am for light physical exercise or yoga. There would also be games in the evening or at other suitable times according to the local climate. These would help develop team work. Each student should pick one game and learn it for three weeks. There could also be gardening or other suitably designed activity where labour yields fruits from nature.

2.2 Creative Arts

Every student would chose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program.

These would allow for creative expression. It would develop a sense of aesthetics and also enhance creativity which would, hopefully, flow into engineering design later.

2.3 Universal Human Values

It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting staff in the hostel and department, be sensitive to others, etc. Need for character building has been underlined earlier. A module in Universal Human Values provides the base.

Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing. The role of group discussions, however, with clarity of thought of the teachers cannot be over emphasized. It is essential for giving exposure, guiding thoughts, and realizing values.

The teachers must come from all the departments rather than only one department like HSS or from outside of the Institute. Experiments in this direction at IIT(BHU) are noteworthy and one can learn from them.[3]

Discussions would be conducted in small groups of about 20 students with a faculty mentor each. It is to open thinking towards the self. Universal Human Values discussions could even continue for rest of the semester as a normal course, and not stop with the induction program.

Besides drawing the attention of the student to larger issues of life, it would build relationships between teachers and students which last for their entire 4-year stay and possibly beyond.

[3]The Universal Human Values Course is a result of a long series of experiments at educational institutes starting from IIT-Delhi and IIT Kanpur in the 1980s and 1990s as an elective course, NIT Raipur in late 1990s as a compulsory one-week off campus program. The courses at IIT(BHU) which started from July 2014, are taken and developed from two compulsory courses at IIIT Hyderabad first introduced in July 2005.

2.4 Literary

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

2.5 Proficiency Modules

This period can be used to overcome some critical lacunas that students might have, for example, English, computer familiarity etc. These should run like crash courses, so that when normal courses start after the induction program, the student has overcome the lacunas substantially. We hope that problems arising due to lack of English skills, wherein students start lagging behind or failing in several subjects, for no fault of theirs, would, hopefully, become a thing of the past.

2.6 Lectures by Eminent People

This period can be utilized for lectures by eminent people, say, once a week. It would give the students exposure to people who are socially active or in public life.

2.7 Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

2.8 Familiarization to Dept./Branch & Innovations

The students should be told about diff erent method of study compared to coaching that is needed at IITs. They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilties.

3. Schedule

The activities during the Induction Program would have an Initial Phase, a Regular Phase and a Closing Phase. The Initial and Closing Phases would be two days each.

Time	Activity
Day 0 Whole Day	Student arrive – Hostel allotment. (Preferably do pre-allotment)
Day-1 09:00 am- 03:00 pm 04:30 pm - 06:00 pm	 Academic Registration Orientation
Day-2 09:00 am - 10:00 am	 Diagnostic Test (for English etc.)
10:15am - 12:25 pm	Visit to respective depts..
12:30 pm - 01:55 pm	Lunch
02:00 pm -02:55 pm	Director's address
03:00 pm – 05:00 pm	Interaction with parents
03:30 pm – 05:00 pm	Mentor-mentee groups – introduction within group (Same as Universal Human Values groups)

3.2 Regular Phase

After two days is the start of the Regular Phase of induction. With this phase there would be regular program to be followed every day.

3.2.1 Daily Schedule

Some of the activities are on a daily basis, while some others are at specified periods within the Induction Program. We first show a typical daily timetable.

Sessn.	*Time*	*Activity*	*Remarks*
	Day 3 onwards		
	06:00 am	*Wake up call*	
I	06:30 am - 07:10 am	Physical activity (mild exercise/yoga)	
	07:15 am - 08:55 am	*Bath, Breakfast, etc.*	
II	09:00 am - 10:55 am	Creative Arts / Universal Human Values	Half the groups do Creative Arts
III	11:00 am - 12:55 pm	Universal Human Values / Creative Arts	Complementary alternate
	01:00 pm - 02:25 pm	*Lunch*	
IV	02:30 pm - 03:55 pm	Afternoon Session	See below.
V	04:00 pm - 05:00 pm	Afternoon Session	See below.
	05:00 pm - 05:25 pm	*Break / light tea*	
VI	05:30 pm - 06:45 pm	Games / Special Lectures	
	06:50 pm - 08:25 pm	*Rest and Dinner*	
VII	08:30 pm - 09:25 pm	Informal interactions (in hostels)	

Sundays are off . Saturdays have the same schedule as above or have outings.

3.2.2 Afternoon Activities (Non-Daily)

The following five activities are scheduled at different times of the Induction Program, and are not held daily for everyone:

1. Familiarization to Dept. / Branch & Innovations
2. Visits to Local Area
3. Lectures by Eminent People
4. Literary
5. Proficiency Modules

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Here is the approximate activity schedule for the afternoons (may be changed to suit local needs):

Activity	*Session*	*Remarks*
Familiarization with Dept/Branch & Innovations	IV	For 3 days (Day 3 to 5)
Visits to Local Area	IV, V and VI	For 3 days - interspersed (e.g., 3 Saturdays)
Lectures by Eminent People	IV	As scheduled - 3-5 lectures
Literary (Play / Book Reading / Lecture)	IV	For 3-5 days
Proficiency Modules	V	Daily, but only for those who need it

3.3 Closing Phase

Time	*Activity*
Last But One Day	
08:30 am - 12 noon	Discussions and finalization of presentation within each group
02:00 am - 05:00 pm	Presentation by each group in front of 4 other groups besides their own (about 100 students)
Last Day	
Whole day	Examinations (if any). May be expanded to last 2 days, in case needed.

3.4 Follow Up after Closure

A question comes up as to what would be the follow up program after the formal 3-week Induction Program is over? The groups which are formed should function as mentor-mentee network. A student should feel free to approach his faculty mentor or the student guide, when facing any kind of problem, whether academic or financial or psychological etc. (For every 10 undergraduate first year students, there would be a senior student as a *student guide*, and for every 20 students, there would be a *faculty mentor*.) Such a group should remain for the entire 4-5 year duration of the stay of the student. Therefore, it would be good to have groups with the students as well as teachers from the same department/discipline[4].
Here we list some important suggestions which have come up and which have been experimented with.

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3.4.1 Follow Up after Closure – Same Semester

It is suggested that the groups meet with their faculty mentors once a month, within the semester after the 3-week Induction Program is over. This should be a scheduled meeting shown in the timetable. (The groups are of course free to meet together on their own more often, for the student groups to be invited to their faculty mentor’s home for dinner or tea, nature walk, etc.)

3.4.2 Follow Up – Subsequent Semesters

It is extremely important that continuity be maintained in subsequent semesters.

It is suggested that at the start of the subsequent semesters (upto fourth semester), three days be set aside for three full days of activities related to follow up to Induction Program. The students be shown inspiring films, do collective art work, and group discussions be conducted. Subsequently, the groups should meet at least once a month.

Summary

Engineering institutions were set up to generate well trained manpower in engineering with a feeling of responsibility towards oneself, one’s family, and society. The incoming undergraduate students are driven by their parents and society to join engineering without understanding their own interests and talents. As a result, most students fail to link up with the goals of their own institution.

The graduating student must have values as a human being, and knowledge and meta-skills related to his/her profession as an engineer and as a citizen. Most students who get demotivated to study engineering or their branch, also lose interest in learning.

The *Induction Program* is designed to make the newly joined students feel comfortable, sensitize them towards exploring their academic interests and activities, reducing compe-tition and making them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and building of character.

The *Universal Human Values* component, which acts as an anchor, develops awareness and sensitivity, feeling of equality, compassion and oneness, draw attention to society and

[4] We are aware that there are advantages in mixing the students from diff erent depts. However, in mixing, it is our experience that the continuity of the group together with the faculty mentor breaks down soon after. Therefore, the groups be from the same dept. but hostel wings have the mixed students from diff erent depts. For example, the hostel room allotment should be in alphabetical order irrespective of dept.

nature, and character to follow through. It also makes them reflect on their relationship with their families and extended family in the college (with hostel staff and others). It also connects students with each other and with teachers, so that they can share any difficulty they might be facing and seek help.

References:

Motivating UG Students Towards Studies,

Rajeev Sangal, IITBHU Varanasi, Gautam Biswas, IIT Guwahati, Timothy Gonsalves, IIT Mandi, Pushpak Bhattacharya, IIT Patna, (Committee of IIT Directors), 31 March 2016, IIT Directors' Secretariat, IIT Delhi.

Contact: *Prof. Rajeev Sangal* Director, IIT(BHU), Varanasi, (director@iitbhu.ac.in)

Semester 1st

Sr. No.	Branch	Related Branches	Course codes	Course title	Credits
1	Civil Engineering	1. Civil Engineering	BTPH101-18	Mechanics of solids	4
		2.Construction Engineering & Management	BTPH111-18	Mechanics of solids Lab	1.5
2	Electrical Engineering	1.Electrical Engineering	BTPH102-18	Optics and Modern Physics	4
		2.Automation & Robotics			
		3.Electrical & Electronics Engineering	BTPH112-18	Optics and Modern Physics Lab	1.5
		4.Electronics & Electrical Engineering			
		5.Electrical Engineering & Industrial Control			
		6.Instrumentation & Control Engineering			
3	Mechanical Engineering	1.Mechanical Engineering	BTPH103-18	Electromagnetism	4
		2.Marine Engineering	BTPH113-18	Electromagnetism Lab	1.5
		3.Production Engineering			
		4.Industrial Engineering			
		5.Tool Engineering			
		6.Automobile Engineering			
		7.Aerospace Engineering			
		8.Aeronautical Engineering			

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4	Computer Science Engineering	1.Computer Engineering	BTPH104-18	Semiconductor Physics	4
		2.Computer Science Engineering			
		3.Information Technology	BTPH114-18	Semiconductor Physics Lab	1.5
		4.3D Animation Engineering			
		5 CSE (Artificial Intelligence & Machine Learning			
		6 CSE (Data Science)			
		7 CSE(IoT & Cyber Security including Block Chain Technology)			
		8 CSE (Internet of Things)			
		9 Artificial Intelligence & Data Science			
5	Electronics and communication Engineering	1.Electronics & Communication Engineering	BTPH105-18	Semiconductor and Optoelectronics Physics	4
		2.Electronics & Computer Engineering			
		3.Electronics & Instrumentation Engineering	BTPH115-18	Semiconductor and Optoelectronics Physics Lab	1.5
		4.Electronics & Telecomm Engineering			
		5.Electronics Engineering			
6	Chemical Sciences	1.Chemical Engineering	BTPH106-18	Optics and Electromagnetism	4
		2.Petrochem & Petroleum Refinery Engineering	BTPH116-18	Optics and Electromagnetism Lab	1.5
		3.Textile Engineering			
		4.Food Technology			

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7	Bio-Technology	1 Bio-Technology 2 Agricultural Engineering	BTPH107-18	Introduction to Physics: Biotechnology	4
			BTPH117-18	Physics Lab	1.5

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BTPH101-18	**Mechanics of Solids**	**L-3, T-1, P-0**	**4 Credits**
Pre-requisites (if any): High-school education with Physics as one of the subject.			
Course Objectives: The aim and objective of the course on **Mechanics of Solids** is to introduce the students of B. Tech. to the formal structure of vector mechanics, harmonic oscillators, and mechanics of solids so that they can use these in Engineering as per their requirement.			
Course Outcomes: At the end of the course, the student will be able to			
CO1	Understand the vector mechanics for a classical system.		
CO2	Identify various types of forces in nature, frames of references, and conservation laws.		
CO3	Know the simple harmonic, damped, and forced simple harmonic oscillator for a mechanical system.		
CO4	Analyze the planar rigid body dynamics for a mechanical system.		
CO5	Apply the knowledge obtained in this course to the related problems.		

Detailed Syllabus:

PART-A

UNIT I: Vector mechanics *(10 lectures)*

Physical significance of gradient, Divergence and curl. Potential energy function, F = - Grad V, equipotential surfaces, Forces in Nature, Newton's laws and its completeness in describing particle motion, Conservative and non-conservative forces, curl of a force field; Central forces; Conservation of Angular Momentum and Energy, Introduction to Cartesian, spherical and cylindrical coordinate system, Inertial and Non-inertial frames of reference; Rotating coordinate system :- Centripetal and Coriolis accelerations.

UNIT II: Simple harmonic motion, damped and forced simple harmonic oscillator *(10 lectures)*

Mechanical simple harmonic oscillators, damped oscillations, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical oscillators, resonance.

PART-B

UNIT III: Planar rigid body mechanics *(10 lectures)*

Definition and motion of a rigid body in plane; Rotation in the plane, Angular momentum about a point of a rigid body in planar motion; center of mass, moment of inertia, theorems of moment of inertia, inertia of plane lamina, circular ring, moment of force, couple, Euler's laws of motion.

UNIT IV: Mechanics of solids ***(10 lectures)***

Friction: Definitions: Types of friction, Laws of static friction, Limiting friction, Angle of friction, angle of repose; motion on horizontal and inclined planes. Methods of reducing friction, Concept of stress and strain at a point; Concepts of elasticity, plasticity, strain hardening, failure (fracture/yielding), one dimensional stress-strain curve; Generalized Hooke's law. Force analysis — axial force, shear force, bending moment and twisting moment. Bending stress; Shear stress; Concept of strain energy; Yield criteria.

Reference books and suggested reading:

1. Engineering Mechanics, 2nd ed. - MK Harbola, Cengage Learning India, 2013.
2. Introduction to Mechanics - MK Verma, CRC Press Book, 2009.
3. Mechanics- DS Mathur, S Chand Publishing, 1981.
4. An Introduction to Mechanics - D Kleppner & R Kolenkow, Tata McGraw Hill 2009.
5. Principles of Mechanics - JL Synge & BA Griffiths, Nabu Press, 2011.
6. Mechanics - JP Den Hartog, Dover Publications Inc, 1961.
7. Engineering Mechanics- Dynamics, 7th ed. - JL Meriam, Wiley.
8. Theory of Vibrations with Applications -WT Thomson, Pearson.
9. An Introduction to the Mechanics of Solids, 2nd ed. with SI Units-SH Crandall, NC Dahl & TJ Lardner
10. Classical Mechanics- H. Goldstein, Pearson Education, Asia.
11. Classical mechanics of particles and rigid bodies-K.C Gupta, Wiley eastern, New Delhi.
12. Engineering Physics-Malik and Singh, Tata McGraw Hill.
13. Engineering Mechanics: Statics- 7th ed.-JL Meriam, Wiley, 2011.
14. Analytical Mechanics-Satish K Gupta, Modern Publishers.
15. https://nptel.ac.in/courses/122102004/

BTPH111-18	Mechanics of Solids Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisites (if any): High-school education with Physics lab as one of the subject.

Course Objectives: The aim and objective of the Lab course on **Mechanics of Solids** is to introduce the students of B. Tech to the formal structure of Mechanics of solids so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be

CO1	Able to understand the concepts learned in the mechanics of solids.
CO2	Learning the skills needed to verify some of the concepts of theory courses.
CO3	Trained in carrying out precise measurements and handling sensitive equipment.
CO4	Able to understand the principles of error analysis and develop skills in experimental design.
CO5	Able to document a technical report which communicates scientific information in a clear and concise manner.

Detailed syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section -A

1. Measurements of length (or diameter) using vernier caliper, screw gauge, and travelling microscope. Use of Plumb line and Spirit level.
2. To determine the horizontal distance between two points using a Sextant.
3. To determine the vertical distance between two points using a Sextant.
4. To determine the height of an inaccessible object using a Sextant.
5. To determine the angular diameter of the sun using the sextant.
6. To determine the angular acceleration α, torque τ, and Moment of Inertia of flywheel.
7. To study the Motion of a Spring and calculate (a) Spring Constant (b) Value of **g** and (c) Modulus of rigidity.
8. To determine the time period of a simple pendulum for different length and acceleration due to gravity.
9. To study the variation of time period with distance between centre of suspension and centre of gravity for a compound pendulum and to determine: (i) Radius of gyration of the bar about an axis through its C.G. and perpendicular to its length. (ii) The value of g in the laboratory.
10. To determine the Young's Modulus of a Wire by Optical Lever Method.
11. To determine the Elastic Constants/Young's Modulus of a Wire by Searle's method.
12. To determine the Modulus of Rigidity of a Wire by Maxwell's needle.
13. To determine the Modulus of Rigidity of brass using Searle's method.
14. To find the moment of inertia of an irregular body about an axis through its C.G with the torsional pendulum.
15. To determine **g** by Kater's Pendulum.
16. To determine **g** and velocity for a freely falling body using Digital Timing Technique.
17. To find out the frequency of AC mains using electric-vibrator.

Section-B

Virtual lab:

1. To determine the angular acceleration α and torque τ of flywheel.
2. To determine the moment of inertia of a flywheel.
3. To find the acceleration of the cart in the simulator.
4. To find the distance covered by the cart in the simulator in the given time interval.
5. To verify that energy conservation and momentum conservation can be used with a ballistic pendulum to determine the initial velocity of a projectile, its momentum and kinetic energy.
6. To verify the momentum and kinetic energy conservation using collision balls.
7. To understand the torsional oscillation of pendulum in different liquid. and determine the rigidity modulus of the suspension wire using torsion pendulum.
8. To find the Time of flight, Horizontal range and maximum height of a projectile for different velocity, angle of projection, cannon height and environment.
9. The Elastic and Inelastic collision simulation will help to analyse the collision variations for different situations.
10. Demonstration of collision behaviour for elastic and inelastic type.
11. Variation of collision behavior in elastic and inelastic type.
12. Study of variation of Momentum, Kinetic energy, Velocity of collision of the objects and the Center of Mass with different velocity and mass.
13. Calculation of the Momentum, Kinetic energy, and Velocity after collision.

Reference book and suggested readings:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
7. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
8. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.
9. Practical Physics, C L Arora. S. Chand & Company Ltd.
10. http://www.vlab.co.in
11. http://vlab.amrita.edu/index.php?sub=1

BTPH102-18	**Optics and Modern Physics**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisite (if any):

1. High-school education with physics as one of the subject.
2. Mathematical course on differential equations.

Course Objectives: The aim and objective of the course on **Optics and Modern Physics** is to introduce the students of B.Tech. to the subjects of wave optics, Quantum Mechanics, Solids, and Semiconductors so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in optics and other wave phenomena.
CO2	Understand optical phenomenon, such as, interference, diffraction etc. in terms of wave model.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same.
CO4	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc. and their applications.
CO5	Understand some of the basic concepts in the physics of solids and semiconductors.

Detailed Syllabus:

PART-A

UNIT I: Waves and Oscillations *(10 lectures)*

Mechanical simple harmonic oscillators, damped harmonic oscillator, forced mechanical oscillators, impedance, steady state motion of forced damped harmonic oscillator, Transverse wave on a string, wave equation on a string, reflection and transmission of waves at a boundary, impedance matching, standing waves, longitudinal waves and their wave equation, reflection and transmission of waves at a boundary.

UNIT II: Optics and LASERS *(10 lectures)*

Optics: Light as an electromagnetic wave, reflectance and transmittance, Fresnel equations (Qualitative idea), Brewster's angle, total internal reflection: Interference: Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Michelson interferometer. Diffraction: Farunhofer diffraction from a single slit and a circular aperture, Diffraction gratings and their resolving power; LASERS: Spontaneous and stimulated emission, Einstein's theory of matter radiation interaction and A and B coefficients; population inversion, pumping, various modes, properties of laser beams, types of lasers: gas lasers (He-Ne), solid-state lasers (ruby), and its applications.

PART-B

UNIT III: Introduction to Quantum Mechanics *(10 lectures)*

Wave nature of Particles, Free-particle wave function and wave-packets, probability densities, Expectation values, Uncertainty principle, Time-dependent and time-independent Schrodinger equation for wave function, Born interpretation, Solution of stationary-state Schrodinger equation for one dimensional problems: particle in a box, linear harmonic oscillator.

UNIT IV: Introduction to Solids and Semiconductors *(10 lectures)*

Free electron theory of metals, Fermi level, density of states in 1, 2 and 3 dimensions, Bloch's theorem for particles in a periodic potential, Origin of energy bands (Qualitative idea); Types of electronic materials: metals, semiconductors, and insulators, Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction.

Reference books and suggested reading:

1. I. G. Main, "Vibrations and waves in physics", Cambridge University Press, 1993.
2. H. J. Pain, "The physics of vibrations and waves", Wiley, 2006.
3. E. Hecht, "Optics", Pearson Education, 2008.
4. A. Ghatak, "Optics", McGraw Hill Education, 2012.
5. O. Svelto, "Principles of Lasers", Springer Science & Business Media, 2010.
6. D. J. Griffiths, "Quantum mechanics", Pearson Education, 2014.
7. R. Robinett, "Quantum Mechanics", OUP Oxford, 2006.
8. D.A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
9. E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore, 1988.
10. B.G. Streetman, "Solid State Electronic Devices", Prentice Hall of India, 1995.
11. HK Malik and AK Singh, Engineering Physics, 2nd ed., Tata McGraw Hill, 2018.
12. S. Sharma and J. Sharma, Engineering Physics, Pearson, 2018.
13. https://nptel.ac.in/courses/117108037/3
14. https://nptel.ac.in/courses/115102023/

BTPH112-18	**Optics and Modern Physics Lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite (If any): High-school education with physics as one of the subject.

Course Objectives: The aim and objective of the lab on **Optic and Modern Physics** is to introduce the students of B.Tech. class to the formal structure of wave and optics, Quantum Mechanics and semiconductor physics so that they can use these in Engineering branch as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic errors.
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
2. Study of diffraction using laser beam and thus to determine the grating element.
3. To study laser interference using Michelson's Interferometer.
4. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
5. To determine attenuation & propagation losses in optical fibres.
6. To determine the grain size of a material using optical microscope.
7. To find the refractive index of a material/glass using spectrometer.
8. To find the refractive index of a liquid using spectrometer.
9. To find the velocity of ultrasound in liquid.
10. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.
11. To study the characteristic of different p-n junction diode - Ge and Si.
12. To analyze the suitability of a given Zener diode as voltage regulator.
13. To find out the intensity response of a solar cell/Photo diode.
14. To find out the intensity response of a LED.
15. To find out the frequency of AC mains using electric-vibrator.

Section-B

Virtual lab:

1. To find the resolving power of the prism.
2. To determine the angle of the given prism.
3. To determine the refractive index of the material of a prism
4. To determine the numerical aperture of a given optic fibre and hence to find its acceptance angle.
5. To calculate the beam divergence and spot size of the given laser beam.
6. To determine the wavelength of a laser using the Michelson interferometer.
7. To revise the concept of interference of light waves in general and thin-film interference in particular.
8. To set up and observe Newton's rings.
9. To determine the wavelength of the given source.
10. To understand the phenomenon Photoelectric effect.
11. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
12. To determine the Planck's constant from kinetic energy versus frequency graph.
13. To plot a graph connecting photocurrent and applied potential.
14. To determine the stopping potential from the photocurrent versus applied potential graph.

Reference books and suggested reading:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
7. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
8. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.
9. Practical Physics, C L Arora. S. Chand & Company Ltd.
10. http://www.vlab.co.in
11. http://vlab.amrita.edu/index.php?sub=1

BTPH103-18	**Electromagnetism**	**L-3, T-1, P-0**	**4 Credits**

Pre-requisites (if any):

1. High-school education with physics as one of the subject.
2. Mathematical course on vector calculus.

Course Objectives: The aim and objective of the course is to expose the students to the formal structure of electromagnetism so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Specify the constitutive relationships for fields and understand their important.
CO2	Describe the static and dynamic electric and magnetic fields for technologically important structures.
CO3	Measure the voltage induced by time varying magnetic flux.
CO4	acquire the knowledge of Maxwell equation and electromagnetic field theory and propagation and reception of electro-magnetic wave systems.
CO5	have a solid foundation in engineering fundamentals required to solve problems and also to pursue higher studies.

Detailed Syllabus:

PART-A

UNIT I: Electrostatics in vacuum and linear dielectric medium *(10 lectures)*

Calculation of electric field and electrostatic potential for a charge distribution; Divergence and curl of electrostatic field; Laplace's and Poisson's equations for electrostatic potential; Uniqueness theorem (Definition); examples: Faraday's cage; Boundary conditions of electric field; Energy of a charge distribution and its expression in terms of electric field. Electrostatic field and potential of a dipole. Bound charges due to electric polarization in Dielectrics; Electric displacement; Solving simple electrostatics problems in presence of dielectrics – Point charge at the centre of a dielectric sphere, charge in front of a dielectric slab.

UNIT II: Magnetostatics in linear magnetic medium *(10 lectures)*

Bio-Savart law, Divergence and curl of static magnetic field; Concept of vector potential, Magnetization and associated bound currents; auxiliary magnetic field $\vec{H}$; Boundary conditions on $\vec{B}$ and $\vec{H}$. Solving for magnetic field due to bar magnet; magnetic susceptibility and ferromagnetic, paramagnetic and diamagnetic materials; magnetic domains, hysteresis and B-H curve.

PART-B

UNIT III: Faraday's law and Maxwell's equations *(10 lectures)*

Faraday's law; equivalence of Faraday's law and motional EMF; Lenz's law; Electromagnetic breaking and its applications; Differential form of Faraday's law; energy stored in a magnetic field. Continuity equation for current densities; Modifying equation for the curl of magnetic field to satisfy continuity equation; displacement current and magnetic field arising from time-dependent electric field; Maxwell's equation in vacuum and non-conducting medium; Flow of energy and Poynting vector and Poynting theorem.

UNIT IV: Electromagnetic waves *(10 lectures)*

Wave equation for electromagnetic waves in free space and conducting medium, Uniform plane waves and general solution of uniform plane waves, relation between electric and magnetic fields of an electromagnetic wave their transverse nature.; Linear, circular and elliptical polarization, Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

Text and Reference Books:

1. D. Griffiths, Introduction to Electrodynamics, Pearson Education India; 4th ed. (2015).
2. J D Jackson, Classical Electrodynamics, John Wiley and Sons (1999).
3. Halliday and Resnick, Fundamentals of Physics, Wiley (2011).
4. W. Saslow, Electricity, Magnetism and Light, Academic Press (2002).
5. HK Malik and AK Singh, Engineering Physics, 2nd ed., Tata McGraw Hill (2018).

BTPH113-18	**Electromagnetism Lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite (If any): High-school education

Course Objectives: The aim and objective of the lab course on **Electromagnetism** is to introduce the students of B. Tech. class to the formal structure of electromagnetism so that they can use these in various branches of engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	understand the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. Use a Multimeter for measuring (a) Resistances, (b) AC and DC Voltages, (c) DC Current, (d) Capacitances, and (e) Checking electrical fuses.
2. To study the magnetic field of a circular coil carrying current.
3. To study B-H curve for a ferromagnetic material using CRO.
4. To find out the frequency of AC mains using electric-vibrator.
5. To find out polarizability of a dielectric substance.
6. Determine a high resistance by leakage method using Ballistic Galvanometer.
7. To study the characteristics of a Series RC Circuit.
8. To study the series LCR circuit and determine its (a) Resonant Frequency, (b) Quality.
9. To study a parallel LCR circuit and determine its (a) Anti-resonant frequency (b) Quality factor Q.
10. To determine the value of self-inductance by Maxwell Inductance Bridge.
11. To determine the value of self-inductance by Maxwell Inductance Capacitance Bridge.
12. To determine the mutual inductance of two coils by Absolute method.
13. To study the induced emf as a function of the velocity of magnet and to study the phenomenon of electromagnetic damping.
14. To determine unknown capacitance by flashing and quenching method.
15. To study the field pattern of various modes inside a rectangular waveguide.
16. To determine charge to mass ratio (e/m) of an electron by helical method.
17. To determine charge to mass ratio (e/m) of an electron by Thomson method.
18. To find out the horizontal component of earth's magnetic field (B_h).

Section-B

Virtual lab:

1. To find out the horizontal component of earth's magnetic field (B_h).
2. An experiment to study the variation of magnetic field with distance along the axis of a circular coil carrying current.
3. Aim is to find the horizontal intensity of earth's magnetic field at a place and moment of the bar magnet.
4. To determine the self-inductance of the coil (L) using Anderson's bridge.
5. To calculate the value of inductive reactance (X_L) of the coil at a particular frequency.
6. The temperature coefficient of resistor simulation will help the user to easily identify the change in resistivity of the resistor according to the change in temperature.

Reference books and suggested reading:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
7. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
8. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.
9. Practical Physics, C L Arora, S. Chand & Company Ltd.
10. http://www.vlab.co.in
11. http://vlab.amrita.edu/index.php?sub=1

IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1st Year)

BTPH104-18	**Semiconductor Physics**	**L-3, T-1, P-0**	**4 Credits**

Prerequisite (if any): Introduction to Quantum Mechanics desirable

Course Objectives: The aim and objective of the course on **Semiconductor Physics** is to introduce the students of B. Tech. class to the formal structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and explain the fundamental principles and properties of electronic materials and semiconductors
CO2	Understand and describe the interaction of light with semiconductors in terms of fermi golden rule.
CO3	Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
CO4	Understand the design, fabrication, and characterization techniques of Engineered semiconductor materials.
CO5	Develop the basic tools with which they can study and test the newly developed devices and other semiconductor applications.

Detailed Syllabus:

PART-A

UNIT 1: Electronic materials *(10 lectures)*

Free electron theory of metals, Density of states in 1D, 2D, and 3D, Bloch's theorem for particles in a periodic potential, Energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect bandgaps, Types of electronic materials: metals, semiconductors, and insulators, Occupation probability, Fermi level, Effective mass.

UNIT II: Semiconductors *(10 lectures)*

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky), Semiconductor materials of interest for optoelectronic devices.

PART-B

UNIT III: Light-semiconductor interaction *(10 lectures)*

Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Einstein coefficients, Population inversion, application in semiconductor Lasers; Joint density of states, Density of states for phonons, Transition rates (Fermi's golden rule), Optical loss and gain; Photovoltaic effect, Exciton, Drude model.

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UNIT IV: Measurement Techniques ***(10 lectures)***

Measurement for divergence and wavelength using a semiconductor laser, Measurements for carrier density, resistivity, hall mobility using Four-point probe and van der Pauw method, Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics.

Reference books and suggested reading:

1. J. Singh: Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich: Fundamentals of Photonics, John Wiley & Sons, Inc., (2007).
3. S. M. Sze: Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya: Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Ben G. Streetman: Solid State Electronics Devices, Pearson Prentice Hall.
7. D.A. Neamen, "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
8. E.S. Yang, "Microelectronic Devices", McGraw Hill, Singapore, 1988.
9. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
10. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

BTPH114-18	Semiconductor Physics Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite (if any): (i) High-school education

Course Objectives: The aim and objective of the Lab course on **Semiconductor Physics** is to introduce the students of B.Tech. class to the formal structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. To study the characteristic of different PN junction diode-Ge and Si.
2. To analyze the suitability of a given Zener diode as a power regulator.
3. To find out the intensity response of a solar cell/Photo diode.
4. To find out the intensity response of a LED.
5. To determine the band gap of a semiconductor.
6. To determine the resistivity of a semiconductor by four probe method.
7. To confirm the de Broglie equation for electrons.
8. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
9. To study the magnetic field of a circular coil carrying current.
10. To find out polarizability of a dielectric substance.
11. To study B-H curve of a ferro-magnetic material using CRO.
12. To find out the frequency of AC mains using electric-vibrator.
13. To find the velocity of ultrasound in liquid.
14. To study the Hall effect for the determination of charge current densities.
15. Distinguish between Diamagnetic material, Paramagnetic and ferromagnetic material.
16. Measurement of susceptibility of a liquid or a solution by Quincke's method.
17. To study the sample with the nano-scale objects and measure surface topography with different scales, width and height of nano objects, and force-distance curves using AFM.
18. To study the temperature coefficient of Resistance of copper.
19. To determine the ratio k/e Using a transistor.
20. To compare various capacitance and verify the law of addition of capacitance.
21. To determine dipole moment of an organic molecule acetone.
22. To measure the temperature dependence of a ceramic capacitor.
23. Verification of the curie Weiss law for the electrical susceptibility of a ferromagnetic material.
24. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.

25. To study laser interference using Michelson's Interferometer.
26. Study of diffraction using laser beam and thus to determine the grating element.

Section-B

Virtual lab:

1. To draw the static current-voltage (I-V) characteristics of a junction diode.
2. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
3. To determine the resistivity of semiconductors by Four Probe Method.
4. To study Zener diode voltage as regulator and measure its line and load regulation.
5. To study the B-H Curve for a ferromagnetic material.
6. To study the Hall effect experiment to determine the charge carrier density.
7. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
8. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
9. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

Reference books and suggested reading:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11^{th} Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4^{th} Edition, Cambridge University Press.
6. Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
7. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
8. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.
9. Practical Physics, C L Arora, S. Chand & Company Ltd.
10. http://www.vlab.co.in
11. http://vlab.amrita.edu/index.php?sub=1

BTPH105-18	**Semiconductor and Optoelectronics Physics**	**L-3, T-1, P-0**	**4 Credits**

Prerequisite (if any): "Introduction to Quantum Mechanics" Desirable

Course Objectives: The aim and objective of the course on **Semiconductor and Optoelectronics Physics** is to introduce the students of B. Tech. class to the formal structure of semiconductor physics and Optoelectronics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Understand and explain the fundamental principles and properties of electronic materials and semiconductors.
CO2	Understand and describe the interaction of light with semiconductors in terms of fermi golden rule.
CO3	Understand and describe the impact of solid-state device capabilities and limitations on electronic circuit performance.
CO4	Understand the design, fabrication, characterization techniques, and measurements of Engineered semiconductor materials.
CO5	Learn the basics of the optoelectronic devices, LEDs, semiconductor lasers, and photo detectors.

Detailed Syllabus:

PART-A

UNIT -I: Electronic materials *(10 lectures)*

Free electron theory of metals, Density of states in 1D, 2D, and 3D, Bloch's theorem for particles in a periodic potential, energy band diagrams, Kronig-Penny model (to introduce origin of band gap), Energy bands in solids, E-k diagram, Direct and indirect band gaps, Types of electronic materials: metals, semiconductors and insulators, Occupation probability, Fermi level, Effective mass of electron and hole.

UNIT -II: Semiconductors *(10 lectures)*

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier generation and recombination, Carrier transport: diffusion and drift, p-n junction, Metal-semiconductor junction (Ohmic and Schottky).

PART-B

UNIT -III: Optoelectronic devices ***(10 lectures)***

Radiative and non-radiative recombination mechanisms in semiconductors, Semiconductor materials of interest for optoelectronic devices; Semiconductor light emitting diodes (LEDs): light emitting materials, device structure, characteristics; Optical transitions in bulk semiconductors: absorption, spontaneous emission, and stimulated emission, Semiconductor laser: population inversion at a junction, structure, materials, device characteristics, Photovoltaics: Types of semiconductor photo detectors-p-n junction, PIN, and Avalanche-and their structure, materials, working principle, and characteristics, Noise limits on performance.

UNIT-IV: Measurement techniques ***(10 lectures)***

Measurement for divergence and wavelength using a semiconductor laser, Measurements for carrier density, resistivity, and hall mobility using Four-point probe and van der Pauw method, Hot-point probe measurement, capacitance-voltage measurements, parameter extraction from diode I-V characteristics.

Reference books and suggested reading:

1. J. Singh, Semiconductor Optoelectronics: Physics and Technology, McGraw-Hill Inc. (1995).
2. B. E. A. Saleh and M. C. Teich, Fundamentals of Photonics, John Wiley & Sons, Inc. (2007).
3. S. M. Sze, Semiconductor Devices: Physics and Technology, Wiley (2008).
4. A. Yariv and P. Yeh, Photonics: Optical Electronics in Modern Communications, Oxford University Press, New York (2007).
5. P. Bhattacharya: Semiconductor Optoelectronic Devices, Prentice Hall of India (1997).
6. Solid state electronics devices: Ben. G. Streetman Pearson Prentice Hall.
7. D.A. Neamen: "Semiconductor Physics and Devices", Times Mirror High Education Group, Chicago, 1997.
8. E.S. Yang: "Microelectronic Devices", McGraw Hill, Singapore, 1988.
9. Online course: "Semiconductor Optoelectronics" by M R Shenoy on NPTEL.
10. Online course: "Optoelectronic Materials and Devices" by Monica Katiyar and Deepak Gupta on NPTEL.

BTPH115-18	Semiconductor and Optoelectronics Physics Lab	L-0, T-0, P-3	1.5 Credits

Pre-requisite (if any): High-school education

Course Objectives: The aim and objective of the Lab course on **Semiconductor and Optoelectronics Physics** is to introduce the students of B.Tech. class to the formal lab structure of semiconductor physics so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. To study the characteristic of different PN junction diode-Ge and Si.
2. To analyze the suitability of a given Zener diode as a power regulator.
3. To find out the intensity response of a solar cell/Photo diode.
4. To find out the intensity response of a LED.
5. To determine the band gap of a semiconductor.
6. To determine the resistivity of a semiconductor by four probe method.
7. To confirm the de Broglie equation for electrons.
8. To study voltage regulation and ripple factor for a half-wave and a full-wave rectifier without and with different filters.
9. To study the magnetic field of a circular coil carrying current.
10. To find out polarizability of a dielectric substance.
11. To study B-H curve of a ferro-magnetic material using CRO.
12. To find out the frequency of AC mains using electric-vibrator.
13. To find the velocity of ultrasound in liquid.
14. To study the Hall effect for the determination of charge current densities.
15. Distinguish between diamagnetic material, paramagnetic and ferromagnetic material.
16. Measurement of susceptibility of a liquid or a solution by Quincke's method.
17. To study the sample with the nano-scale objects and measure surface topography with different scales, width and height of nano objects, and force-distance curves using AFM.
18. To study the temperature coefficient of Resistance of copper.
19. To determine the ratio k/e using a transistor.
20. To compare various capacitance and verify the law of addition of capacitance.
21. To measure the temperature dependence of a ceramic capacitor.
22. Verification of the curie Weiss law for the electrical susceptibility of a ferromagnetic material.

23. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
24. To study laser interference using Michelson's Interferometer.
25. Study of diffraction using laser beam and thus to determine the grating element.

Section-B

Virtual lab:

1. To draw the static current-voltage (I-V) characteristics of a junction diode.
2. To plot the characteristics of thermistor and hence find the temperature coefficient of resistance.
3. To determine the resistivity of semiconductors by Four Probe Method.
4. To study Zener diode voltage as regulator and measure its line and load regulation.
5. To study the B-H Curve for a ferromagnetic material.
6. To study the Hall effect experiment to determine the charge carrier density.
7. To determine the magnetic susceptibilities of paramagnetic liquids by Quincke's Method.
8. To study the phenomena of magnetic hysteresis and calculate the retentivity, coercivity and saturation magnetization of a material using a hysteresis loop tracer.
9. Verification and design of combinational logic using AND, OR, NOT, NAND and XOR gates.

Reference books and suggested reading:

1. Advanced Practical Physics for students, B.L. Flint and H.T. Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers.
3. A Text Book of Practical Physics, I. Prakash & Ramakrishna, 11th Edn, 2011, Kitab Mahal.
4. Engineering Practical Physics, S. Panigrahi & B. Mallick, 2015, Cengage Learning India Pvt. Ltd.
5. Practical Physics, G.L. Squires, 2015, 4th Edition, Cambridge University Press.
6. Laboratory Experiments in College Physics, C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
7. Practical Physics, G.L. Squires, Cambridge University Press, Cambridge, 1985.
8. Experiments in Modern Physics, A.C. Melissinos, Academic Press, N.Y., 1966.
9. Practical Physics, C L Arora, S. Chand & Company LTD.
10. http://www.vlab.co.in
11. http://vlab.amrita.edu/index.php?sub=1

BTPH106-18	**Optics and Electromagnetism**	**L-3, T-1, P-0**	**4 Credits**

Prerequisite (if any): Introduction to Quantum Mechanics desirable

Course Objectives: The aim and objective of the course on **Optics and Electromagnetism** is to introduce the students of B.Tech. class to the basic concepts of optics and its applications, electricity and magnetism, and quantum physics, so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to understand

CO1	Identify and illustrate physical concepts and terminology used in optics and other wave phenomena.
CO2	Understand optical phenomena such as polarization, birefringence, interference, and diffraction in terms of the wave model.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same
CO4	Acquire knowledge about the Maxwell equation and magnetic properties of materials.
CO5	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc.

Detailed syllabus:

PART-A

Unit I: Wave Optics (*8 lectures*)

Diffraction: Introduction to interference and example; concept of diffraction, Fraunhofer and Fresnel diffraction, Fraunhofer diffraction at single slit, double slit, and multiple slits; diffraction grating, characteristics of diffraction grating and its applications; Polarization: Introduction to polarization, polarisation by reflection, polarisation by double refraction, scattering of light, circular and elliptical polarisation, optical activity.

UNIT-II: Fibre Optics and LASERS (*12 lectures*)

Fibre Optics: Introduction, optical fibre as a dielectric wave guide: total internal reflection, numerical aperture and various fibre parameters, losses associated with optical fibres, step and graded index fibres, application of optical fibres; LASERS: Spontaneous and stimulated emission, Einstein's theory of matter radiation interaction and A and B coefficients; population inversion, pumping, various modes, properties of laser beams, types of lasers: gas lasers (He-Ne), solid-state lasers (ruby), applications.

PART-B

UNIT-III: Electromagnetism and Magnetic Properties of Materials *(10 lectures)*

Laws of electrostatics: Coulomb and Gauss Law, electric current and the continuity equation, laws of magnetism: Ampere’s and Faraday’s laws. Maxwell’s equations (derivation and physical significance), Dielectric polarisation, permeability and dielectric constant, polar and non-polar dielectrics, internal fields in a solid, Clausius-Mossotti equation, applications of dielectrics; Magnetisation, permeability and susceptibility, classification of magnetic materials, ferromagnetism, magnetic domains and hysteresis, applications.

Unit IV: Quantum Mechanics *(10 lectures)*

Introduction to quantum physics, black body radiation, explanation using the photon concept, photoelectric effect, Compton effect, de Broglie hypothesis, wave-particle duality, Born’s interpretation of the wave function, Davisson and Germer experiment: verification of matter waves, uncertainty principle, Schrodinger wave equation: particle in 1-dimensional box.

Reference books and suggested reading:

1. "Fundamentals of Physics", 6th Ed., D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, Inc., New York, 2001.
2. "Physics", M. Alonso and E.J. Finn, Addison Wesley, .1992.
3. "Fundamentals of Optics", 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill Book Co., 1981.
4. "Optics", A Ghatak, Tata-McGraw Hill, New Delhi, 1992.
5. "Vibration and Waves", A.P. French, Arnold-Heinemann, New Delhi, 1972.
6. “Vibrations and waves in physics”, I. G. Main, Cambridge University Press, 1993.
7. “The physics of vibrations and waves”, H. J. Pain, Wiley, 2006.
8. “Optics”, E. Hecht, Pearson Education, 2008.
9. “Optics”, A. Ghatak, McGraw Hill Education, 2012.
10. “Principles of Lasers”, O. Svelto, Springer Science & Business Media, 2010.
11. “Quantum mechanics”, D. J. Griffiths, Pearson Education, 2014.
12. “Quantum Mechanics”, R. Robinett, OUP Oxford, 2006.
13. “Semiconductor Physics and Devices”, D.A. Neamen, Times Mirror High Education Group, Chicago, 1997.
14. “Microelectronic Devices”, E.S. Yang, McGraw Hill, Singapore, 1988.
15. “Solid State Electronic Devices”, B.G. Streetman, Prentice Hall of India, 1995.
16. HK Malik and AK Singh, Engineering Physics, 2nd ed., Tata McGraw Hill (2018).
17. https://nptel.ac.in/courses/117108037/3
18. https://nptel.ac.in/courses/115102023/

BTPH116-18	**Optics and Electromagnetism Lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite (if any): High-school education

Course Objectives: The aim and objective of the lab on Optics and Electromagnetism is to provide students the firsthand experience of verifying various theoretical concepts learnt in theory courses so that they can use these in their branch of Engineering as per their requirement.

Laboratory Outcomes: At the end of the course, students will be

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic "errors."
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
4. To study laser interference using Michelson’s Interferometer.
5. Study of diffraction using laser beam and thus to determine the grating element.
6. To determine numerical aperture of an optical fibre.
7. To determine attenuation & propagation losses in optical fibres.
8. To find out the frequency of AC mains using electric-vibrator.
9. To find the refractive index of a material using spectrometer.
10. To find the refractive index of a liquid using spectrometer.
11. To study B-H curve for a ferromagnetic material using CRO.
12. To find the velocity of ultrasound in liquid.
13. To determine the grain size of a material using optical microscope.
14. To study the characteristics of solar cell.
15. To study the Characteristics of Light Emitting Diode (LED).
16. To determine the energy gap of a given semi-conductor.
17. To determine the specific rotation of sugar using Laurent’s half-shade polarimeter.

Section-B

Virtual lab:

1. To find the resolving power of the prism.
2. To determine the angle of the given prism.
3. To determine the refractive index of the material of a prism.
4. To find the numerical aperture of a given optic fibre and hence to find its acceptance angle.
5. To calculate the beam divergence and spot size of the given laser beam.
6. To determine the wavelength of a laser using the Michelson interferometer.
7. To revise the concept of interference of light waves in general and thin-film interference in particular.
8. To set up and observe Newton's rings.
9. To determine the wavelength of the given source.
10. To understand the phenomenon Photoelectric effect as a whole.
11. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
12. To determine the Planck's constant from kinetic energy versus frequency graph.
13. To plot a graph connecting photocurrent and applied potential
14. To determine the stopping potential from the photocurrent versus applied potential graph.

Reference books and suggested reading:

1. "Fundamentals of Physics", 6th Ed., D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, Inc., New York, 2001.
2. "Physics", M. Alonso and E.J. Finn, Addison Wesley, .1992.
3. "Fundamentals of Optics", 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill Book Co., 1981.
4. "Optics", A Ghatak, Tata-McGraw Hill, New Delhi, 1992
5. "Vibration and Waves", A.P. French, Arnold-Heinemann, New Delhi, 1972.
6. "Students Reference Manual for Electronic Instrumentation Laboratories",
7. "Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
8. "Practical Physics", G.L. Squires, Cambridge University Press, Cambridge, 1985.
9. "Experiments in Modern Physics", A.C. Melissinos, Academic Press, N.Y., 1966.
10. "Practical Physics", C L Arora. S. Chand & Company LTD.
11. http://www.vlab.co.in
12. http://vlab.amrita.edu/index.php?sub=1

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BTPH107-18	Introduction to Physics in Biotechnology	L-3, T-1, P-0	4 Credits

Prerequisite (if any): High School knowledge

Course Objectives: The aim and objective of the course on Introduction to Physics in Biotechnology is to introduce the students of B. Tech. class to the basic concepts and applications of Lasers, fibre optics, X-rays, magnetic material, superconductivity and a brief introduction to quantum physics, so that they can use these in Engineering as per their requirement.

Course Outcomes: At the end of the course, the student will be able to

CO1	Identify and illustrate physical concepts and terminology used in Lasers, fibre optics and other wave phenomena.
CO2	Understand the X-Rays and their applications to the ultrasounds.
CO3	Understand the importance of wave equation in nature and appreciate the mathematical formulation of the same
CO4	Appreciate the need for quantum mechanics, wave particle duality, uncertainty principle etc.
CO5	Understand the properties of magnetic materials and superconductivity.

Detailed Syllabus:

PART-A

UNIT I: LASERS and Fibre Optics *(10 lectures)*

Principles and working of laser: population inversion, pumping, threshold population inversion, types of laser: solid state (Ruby), gas (He-Ne); application of lasers (Medical/Industrial Applications); Fibre Optics: Introduction, optical fibre as a dielectric wave guide, total internal reflection, step and graded index fibres, numerical aperture and various fibre parameters, losses associated with optical fibres, application of optical fibres.

UNIT II: Magnetic Materials and Superconductivity *(10 lectures)*

Origin of magnetism, Basic idea of Diamagnetic, Paramagnetic, Ferromagnetic, Ferrimagnetic and Ferrite materials, Soft and Hard Magnetic materials, magnetostriction, magnetic anisotropy, applications of magnetic materials; Superconductivity, properties of superconducting state, Meissner Effect, Type-I and Type-II superconductors, Introduction to BCS theory (Qualitative idea), applications in medical industry.

PART-B

UNIT III: X-rays and Ultrasounds *(10 lectures)*

X-rays, Production of X-rays, Continuous and Characteristic X-Rays, Absorption of X-rays, Bragg's law, Adverse effects of X-rays, X-ray radiography; Ultrasounds: Ultra sound generators, properties of ultrasound-waves and its propagation in biological tissues, Pulse echo techniques, Doppler principle, involvement in design of medical instruments, Adverse effects of ultrasound waves.

UNIT IV: Quantum Theory and Nano-Materials (*(10 lectures)*

Photoelectric effect, Compton effect and de-Broglie waves; Wave-particle duality, concept of Electron microscopy; Nano-materials, surface to volume ratio, electron confinement (qualitative description), top-down and bottom-up method of synthesis, qualitative idea of quantum well, quantum wire and quantum dot. Carbon nanotubes: types, properties and applications.

Text and Reference Books:

1. Engineering Physics, Malik; HK, Singh; AK, Tata McGraw Hill.
2. Concepts of Modern Physics, Beiser; A., Tata McGraw Hill.
3. Introduction to Solids, Azaroff LV, Tata Mc Graw Hill.
4. Engineering Physics, D.K. Bhattacharya, Poonam Tondon, Oxford University Press.
5. Optical Fibre system, Technology, Design & Applications, Kao; CK, McGraw Hill.
6. Laser Theory & Applications, Thygrajan; K, Ghatak; AK, Mc Millan India Ltd.

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BTPH117-18	**Physics lab**	**L-0, T-0, P-3**	**1.5 Credits**

Pre-requisite (if any): High-school education

Course Objectives: The aim and objective of the Physics lab is to provide students the firsthand experience of verifying various theoretical concepts learnt in theory courses so that they can use these in Engineering as per their requirement.

Laboratory Outcomes: At the end of the course, students will be

CO1	Able to verify some of the theoretical concepts learnt in the theory courses.
CO2	Trained in carrying out precise measurements and handling sensitive equipment.
CO3	Introduced to the methods used for estimating and dealing with experimental uncertainties and systematic errors.
CO4	Learn to draw conclusions from data and develop skills in experimental design.
CO5	Write a technical report which communicates scientific information in a clear and concise manner.

Detailed Syllabus:

Note: Students are expected to perform about 10-12 experiments from the following list, selecting minimum of 7-8 from the Section-A and 3-4 from the Section-B.

Section-A

1. To study the magnetic field of a circular coil carrying current.
2. To find out polarizability of a dielectric substance.
3. To study the laser beam characteristics like; wave length using diffraction grating aperture & divergence.
4. To study laser interference using Michelson's Interferometer.
5. Study of diffraction using laser beam and thus to determine the grating element.
6. To determine numerical aperture of an optical fibre.
7. To determine attenuation & propagation losses in optical fibres.
8. To find out the frequency of AC mains using electric-vibrator.
9. To determine the energy gap of a given semi-conductor.
10. To study B-H curve of a ferromagnetic material using CRO.
11. To find the velocity of ultrasound in liquid.
12. To determine the grain size of a material using optical microscope.
13. To study the characteristics of solar cell.
14. To study the Characteristics of Light Emitting Diode (LED).
15. To determine the specific rotation of sugar using Laurent's half-shade polarimeter.

Section-B

Virtual lab:

1. To find the numerical aperture of a given optic fibre and hence to find its acceptance angle.
2. To calculate the beam divergence and spot size of the given laser beam.
3. To determine the wavelength of a laser using the Michelson interferometer.
4. To revise the concept of interference of light waves in general and thin-film interference in particular.
5. To set up and observe Newton’s rings.
6. To determine the wavelength of the given source.
7. To understand the phenomenon Photoelectric effect.
8. To draw kinetic energy of photoelectrons as a function of frequency of incident radiation.
9. To determine the Planck's constant from kinetic energy versus frequency graph.
10. To plot a graph connecting photocurrent and applied potential
11. To determine the stopping potential from the photocurrent versus applied potential graph.

Reference books and suggested reading:

1. "Fundamentals of Physics", 6th Ed., D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, Inc., New York, 2001.
2. "Physics", M. Alonso and E.J. Finn, Addison Wesley, 1992.
3. "Fundamentals of Optics", 4th Ed., F.A. Jenkins and H.E. White, McGraw-Hill Book Co., 1981.
4. "Optics", A Ghatak, Tata-McGraw Hill, New Delhi, 1992
5. "Vibration and Waves", A.P. French, Arnold-Heinemann, New Delhi, 1972.
6. "Students Reference Manual for Electronic Instrumentation Laboratories",
7. "Laboratory Experiments in College Physics", C.H. Bernard and C.D. Epp, John Wiley and Sons, Inc., New York, 1995.
8. "Practical Physics", G.L. Squires, Cambridge University Press, Cambridge, 1985.
9. "Experiments in Modern Physics", A.C. Melissinos, Academic Press, N.Y., 1966.
10. "Practical Physics", C L Arora. S. Chand & Company LTD.
11. http://www.vlab.co.in
12. http://vlab.amrita.edu/index.php?sub=1

IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1st Year)

S.No.	Branch	Related Branches	Course codes	Course title	Credits
1	Civil Engineering-I Sem	1. Civil Engineering	BTAM101-18	Mathematics-I	5
		2.Construction Engineering & Management			
	Civil Engineering-II Sem	1. Civil Engineering	BTAM201-18	Mathematics-II	5
		2.Construction Engineering & Management			
2	Electrical Engineering-I Sem	1.Electrical Engineering	BTAM101-18	Mathematics-I	5
		2.Automation & Robotics			
		3.Electrical & Electronics Engineering			
		4.Electronics & Electrical Engineering			
		5.Electrical Engineering & Industrial Control			
		6.Instrumentation & Control Engineering			
	Electrical Engineering-II Sem	1.Electrical Engineering	BTAM202-18	Mathematics-II	5
		2.Automation & Robotics			
		3.Electrical & Electronics Engineering			
		4.Electronics & Electrical Engineering			
		5.Electrical Engineering & Industrial Control			
		6.Instrumentation & Control Engineering			

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3	Mechanical Engineering-I Sem	1.Mechanical Engineering	BTAM101-18	Mathematics-I	5
		2.Marine Engineering			
		3.Production Engineering			
		4.Industrial Engineering			
		5.Tool Engineering			
		6.Automobile Engineering			
		7.Aerospace Engineering			
		8.Aeronautical Engineering			
	Mechanical Engineering-II Sem	1.Mechanical Engineering	BTAM203-18	Mathematics-II	5
		2.Marine Engineering			
		3.Production Engineering			
		4.Industrial Engineering			
		5.Tool Engineering			
		6.Automobile Engineering			
		7.Aerospace Engineering			
		8.Aeronautical Engineering			
4	Computer Science Engineering-I Sem	1.Computer Engineering	BTAM104-18	Mathematics Paper-I	5
		2.Computer Science Engineering			
		3.Information Technology			
		4.3D Animation Engineering			
		5 CSE (Artificial Intelligence & Machine Learning			
		6 CSE (Data Science)			
		7 CSE(IoT & Cyber Security including Block Chain Technology)			
		8 CSE (Internet of Things)			
		9 Artificial Intelligence & Data Science			

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	Computer Science Engineering-II Sem	1.Computer Engineering	BTAM204-18	Mathematics Paper-II	5
		2.Computer Science Engineering			
		3.Information Technology			
		4.3D Animation Engineering			
		5 CSE (Artificial Intelligence & Machine Learning			
		6 CSE (Data Science)			
		7 CSE(IoT & Cyber Security including Block Chain Technology)			
		8 CSE (Internet of Things)			
		9 Artificial Intelligence & Data Science			
5	Electronics and communication Engineering-I Sem	1.Electronics & Communication Engineering	BTAM101-18	Mathematics-I	5
		2.Electronics & Computer Engineering			
		3.Electronics & Instrumentation Engineering			
		4.Electronics & Telecomm Engineering			
		5.Electronics Engineering			
	Electronics and communication Engineering-II Sem	1.Electronics & Communication Engineering	BTAM202-18	Mathematics-II	5
		2.Electronics & Computer Engineering			
		3.Electronics & Instrumentation Engineering			
		4.Electronics & Telecomm Engineering			
		5.Electronics Engineering			

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6	Chemical Sciences-I Sem	1.Chemical Engineering 2.Petrochem & Petroleum Refinery Engineering 3.Textile Engineering 4.Food Technology	BTAM106-18	Mathematics-I	5
	Chemical Sciences-II Sem	1.Chemical Engineering 2.Petrochem & Petroleum Refinery Engineering 3.Textile Engineering 4.Food Technology	BTAM206-18	Mathematics-II	5
7	Bio-Technology-I Sem	1. Bio-Technology 2. Agricultural Engineering	BTAM107-18	Basic Mathematics-I	5
	Bio-Technology-II Sem	1. Bio-Technology 2. Agricultural Engineering	BTAM207-18	Basic Mathematics-II	5

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BTAM101-18	Mathematics-I (Calculus & LinearAlgebra)	4L:1T:0P	4 credits

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Calculus (10 hours)

Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L' Hôpital's rule; Maxima and minima; Evaluation of definite and Improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-II: Multivariable Calculus (15 hours)

Limit, continuity and partial derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration), Center of mass and Gravity (constant and variable densities).

Section-B

Unit-III: Sequences and Series (12 hours)

Convergence of sequence and series, tests for convergence of positive term series: root test, ratio test, p-test, comparison test; Alternate series and Lebinitz’s test; Power series, Taylor's series, series for exponential, trigonometric and logarithmic functions.

Unit-IV: Matrices (13 hours)

Algebra of matrices, Inverse and rank of a matrix, introduction of null space and kernel, statement of rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Similar matrices; Diagonalization of matrices; Cayley-Hamilton Theorem.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: The students will learn:

- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To apply differential and integral calculus to evaluate definite, improper integrals and its applications.
- The convergence of sequence and series and to apply different tests of convergence
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

BTAM201-18	**Mathematics-II** **(Differential equations)**	**4L:1T:0P**	**4 credits**

Course Objectives:

The objective of this course is to familiarize the prospective engineers with techniques in multivariate integration, ordinary and partial differential equations. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Detailed Contents:

Section A

Unit-I: Ordinary differential equations: First and Higher order (15 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions.

Unit-II: Partial Differential Equations: First order (10 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs. Solution to homogenous and non-homogenous linear partial differential equations second and higher order by complimentary function and particular integral method.

Section B

Unit-III: Partial Differential Equations: higher order (12 hours)

Second-order linear equations and their classification, Initial and boundary conditions (with an informal description of well-posed problems), D'Alembert's solution of the wave equation. Separation of variables method to simple problems in Cartesian coordinates.

Unit-IV: Partial Differential Equations: higher order (contd.) (13 hours)

The Laplacian in plane, cylindrical and spherical polar coordinates. One dimensional diffusion equation and its solution by separation of variables. Boundary-value problems: Solution of boundary-value problems for various linear PDEs.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. G.F. Simmons and S.G. Krantz, Differential Equations, Tata McGraw Hill, 2007.
7. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
8. R. Haberman, Elementary Applied Partial Differential equations with Fourier Series and Boundary Value Problem, 4th Ed., Prentice Hall, 1998.
9. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill, 1964.
10. Manish Goyal and N.P. Bali, Transforms and Partial Differential Equations, University Science Press, Second Edition, 2010.

Course Outcomes: The students will learn:

- The mathematical tools needed in evaluating multiple integrals and their usage.
- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions that are used in various techniques dealing engineering problems.

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Branch/Course: ELECTRICAL ENGINEERING

BTAM101-18	**Mathematics-I** **(Calculus & Linear Algebra)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Calculus (10 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L' Hôpital's rule; Maxima and minima; Evaluation of definite and Improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-II: Multivariable Calculus (15 hours)

Limit, continuity and partial derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration), Center of mass and Gravity (constant and variable densities).

Section-B

Unit-III: Sequences and Series (12 hours)

Convergence of sequence and series, tests for convergence of positive term series: root test, ratio test, p-test, comparison test; Alternate series and Lebinitz's test; Power series, Taylor's series, series for exponential, trigonometric and logarithmic functions.

Unit-IV: Matrices (13 hours)

Algebra of matrices, Inverse and rank of a matrix, introduction of null space and kernel, statement of rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Similar matrices; Diagonalization of matrices; Cayley-Hamilton Theorem.

Text / References:

G.B. Thomas and R.L. Finney, “Calculus and Analytic geometry”, Pearson, 2002.

T. Veerarajan, “Engineering Mathematics”, McGraw-Hill, New Delhi, 2008.

B. V. Ramana, “Higher Engineering Mathematics”, McGraw Hill, New Delhi, 2010.

N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2010.

B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2010.
E. Kreyszig, “Advanced Engineering Mathematics”, John Wiley & Sons, 2006.
D. Poole, “Linear Algebra: A Modern Introduction”, Brooks/Cole, 2005.

V. Krishnamurthy, V. P. Mainra and J. L. Arora, “An introduction to Linear Algebra”, Affiliated East-West press, 2005.

Course Outcomes: The students will learn:

- The differential and integral calculus for applications of definite integrals to evaluate surface areas and volumes of revolutions.
- The fallouts of Rolle’s Theorem that is fundamental to application of analysis to Engineering problems.
- The tool of matrices and convergence of sequence and series for learning advanced Engineering Mathematics.
- The tools of differentiation and integration of functions of multiple variables which are used in various techniques dealing engineering problems.

BTAM202-18	**Mathematics-II** **(Differential Equations & Numerical Methods)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra, transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms, matrices and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Ordinary Differential Equations: First and higher order (13 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Power series solutions.

Unit-II: Partial Differential Equations: First order (12 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Separation of variables method to simple problems.

Section-B

Unit-III: Numerical Methods-I (12 hours)

Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method, Newton-Raphson method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-IV: Numerical Methods-II (13 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods; Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution of two-dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Text / References:

W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.

S. L. Ross, "Differential Equations", Wiley India, 1984.

E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

Course Outcomes: Students will be able to:

- understand the methods which can be used to solve a variety of ordinary and partial differential equations
- demonstrate knowledge of a range of applications of analytical and numerical methods
- develop their attitude towards problem solving.
- Understand how to apply numerical methods to solve the mathematical models.

IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1^{st} Year)

Branch/Course: MECHANICAL ENGINEERING

BTAM101-18	**Mathematics-I** **(Calculus & Linear Algebra)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Calculus (10 hours)

Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L' Hôpital's rule; Maxima and minima; Evaluation of definite and Improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-II: Multivariable Calculus (15 hours)

Limit, continuity and partial derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration), Center of mass and Gravity (constant and variable densities).

Section-B

Unit-III: Sequences and Series (12 hours)

Convergence of sequence and series, tests for convergence of positive term series: root test, ratio test, p-test, comparison test; Alternate series and Lebinitz’s test; Power series, Taylor's series, series for exponential, trigonometric and logarithmic functions.

Unit-IV: Matrices (13 hours)

Algebra of matrices, Inverse and rank of a matrix, introduction of null space and kernel, statement of rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Similar matrices; Diagonalization of matrices; Cayley-Hamilton Theorem.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: The students will learn:

- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To apply differential and integral calculus to evaluate definite, improper integrals and its applications.
- The convergence of sequence and series and to apply different tests of convergence
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

BTAM203-18	**MATHEMATICS II** **(Ordinary Differential** **Equations and Complex Variable)**	**4L:1T:0P**	**5 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, Ordinary differential equations and Complex analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Ordinary differential equations: First Order (12 lectures)

Exact, linear and Bernoulli's equations, Euler's equation, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Unit-II: Ordinary differential equations: Higher orders (13 lectures)

Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation; Power series solutions.

Section-B

Unit-III: Complex Variable – Differentiation (10 lectures)

Elementary functions of complex variables, limit, continuity and differentiability; Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformation and its properties.

Unit-IV: Complex Variable – Integration (15 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine,

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition,Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.

S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.

E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.

J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7thEd., Mc-Graw Hill, 2004.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36thEdition, 2010.

Course Outcomes: The students will learn:

- The effective mathematical tools for the solutions of differential equations that model physical processes.
- The tools of differentiation and integration of functions of a complex variable that are used in various techniques dealing engineering problems.

Branch/Course: COMPUTER SCIENCE AND ENGINEERING

BTAM104-18	**Mathematics Paper-I** **(Calculus & Linear Algebra)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in basic calculus and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Calculus (13 hours)

Rolle’s theorem, Mean value theorems, Statements of Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L' Hôpital's rule; Maxima and minima.

Evaluation of definite and improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions; Beta and Gamma functions and their properties.

Unit-II: Matrix Algebra (12 hours)

Matrices, vectors addition and scalar multiplication, matrix multiplication; Linear systems of equations, linear Independence, rank of a matrix, determinants, Cramer’s Rule, inverse of a matrix, Gauss elimination and Gauss-Jordan elimination.

Section-B

Unit-III: Linear Algebra (13 hours)

Vector Space, linear dependence of vectors, basis, dimension; Linear transformations (maps), range and kernel of a linear map, rank and nullity, statement of rank-nullity theorem, Matrix associated with a linear map.

Unit-IV: Linear Algebra (Contd.) (12 hours)

Eigenvalues, eigenvectors, symmetric, skew-symmetric, and orthogonal Matrices, eigen bases; Similar matrices, diagonalization.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Outcomes: The students will be able

- To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from various applications, they will have a basic understanding of Beta and Gamma functions. The essential tools of matrices and linear algebra including linear transformations, eigenvalues, diagonalization and orthogonalization.

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BTA204-18	Mathematics Paper-II (Probability & Statistics)	4L:1T:0P	4 credits

Course Objective:

The objective of this course is to familiarize the students with statistical techniques. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling various problems in the discipline.

Detailed Content:

Section-A

Unit I: (10 hours)

Measures of Central tendency: Moments, skewness and kurtosis, Variance, Correlation coefficient, Probability, conditional probability, independence; Discrete random variables, Independent random variables, expectation of Discrete random variables.

Unit II: (15 hours)

Probability distributions: Binomial, Poisson and Normal, Poisson approximation to the binomial distribution, evaluation of statistical parameters for these three distributions, Correlation and regression – Rank correlation.

Section-B

Unit III: (10 hours)

Continuous random variables and their properties, distribution functions and densities, normal and exponential densities. Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas.

Unit IV; (15 hours)

Test of significance: Large sample test for single proportion, difference of proportions, single mean, difference of means, and difference of standard deviations.

Test for single mean, difference of means and correlation coefficients, test for ratio of variances - Chi-square test for goodness of fit and independence of attributes.

Suggested Text/Reference Books

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).

S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

T. Veerarajan, Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Course Outcomes: The students will learn:

- The ideas of probability and random variables and various discrete and continuous probability distributions and their properties. The basic ideas of statistics including measures of central tendency, correlation and regression and the statistical methods of studying data samples.

IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1st Year)

Branch/Course: ELECTRONICS & COMMUNICATION ENGINEERING

BTAM101-18	**Mathematics-I** **(Calculus & Linear Algebra)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in calculus, multivariate analysis and linear algebra. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Calculus (10 hours)

Rolle’s theorem, Mean value theorems, Taylor’s and Maclaurin theorems with remainders; Indeterminate forms and L' Hôpital's rule; Maxima and minima; Evaluation of definite and Improper integrals; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Unit-II: Multivariable Calculus (15 hours)

Limit, continuity and partial derivatives, Total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration), Center of mass and Gravity (constant and variable densities).

Section-B

Unit-III: Sequences and Series (12 hours)

Convergence of sequence and series, tests for convergence of positive term series: root test, ratio test, p-test, comparison test; Alternate series and Lebinitz’s test; Power series, Taylor's series, series for exponential, trigonometric and logarithmic functions.

Unit-IV: Matrices (13 hours)

Algebra of matrices, Inverse and rank of a matrix, introduction of null space and kernel, statement of rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Determinants; Eigenvalues and eigenvectors; Similar matrices; Diagonalization of matrices; Cayley-Hamilton Theorem.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, NewDelhi, 2008.

B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi,11th Reprint, 2010.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, LaxmiPublications, Reprint, 2008.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: The students will learn:

- The fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
- To apply differential and integral calculus to evaluate definite, improper integrals and its applications.
- The convergence of sequence and series and to apply different tests of convergence
- To deal with functions of several variables that are essential in most branches of engineering.
- The essential tool of matrices and linear algebra in a comprehensive manner.

BTAM202-18	**Mathematics-II** **(Differential Equations & Numerical Methods)**	**4L:1T:0P**	**4 credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra, transform calculus and numerical methods. It aims to equip the students with standard concepts and tools of integral transforms, matrices and numerical techniques that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Ordinary Differential Equations: First and higher order (13 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type. Second order linear differential equations with variable coefficients, method of variation of parameters, Cauchy-Euler equation, Power series solutions.

Unit-II: Partial Differential Equations: First Order (12 hours)

First order partial differential equations, solutions of first order linear and non-linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Separation of variables method to simple problems.

Section-B

Unit-III: Numerical Methods-I (12 hours)

Solution of polynomial and transcendental equations – Bisection method, Regula-Falsi method, Newton-Raphson method. Finite differences, Interpolation using Newton's forward and backward difference formulae. Central difference interpolation: Gauss's forward and backward formulae. Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules.

Unit-IV: Numerical Methods-II (13 hours)

Ordinary differential equations: Taylor's series, Euler and modified Euler's methods; Runge-Kutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two-dimensional Laplace equation and Poisson equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Text / References:

W. E. Boyce and R. C. DiPrima, "Elementary Differential Equations and Boundary Value Problems", Wiley India, 2009.

S. L. Ross, "Differential Equations", Wiley India, 1984.

E. A. Coddington, "An Introduction to Ordinary Differential Equations", Prentice Hall India, 1995.

E. L. Ince, "Ordinary Differential Equations", Dover Publications, 1958.
G.F. Simmons and S.G. Krantz, "Differential Equations", McGraw Hill, 2007.

N.P. Bali and M. Goyal, "A text book of Engineering Mathematics", Laxmi Publications, 2008.

B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 2010.

Course Outcomes: Students will be able to:

- understand the methods which can be used to solve a variety of ordinary and partial differential equations
- demonstrate knowledge of a range of applications of analytical and numerical methods
- develop their attitude towards problem solving.
- Understand how to apply numerical methods to solve the mathematical models.

IK Gujral Punjab Technical University
Bachelor of Technology (B. Tech. 1st Year)

Branch/Course: CHEMICAL ENGINEERING

BTAM106-18	**Mathematics-I**	**4L:1T:0P**	**5 credits**

Course Objectives: The objective of this course is to introduce matrices, vectors, linear system of equations, eigen values and eigen vectors. Vectors are basic to this course. We will learn to manipulate them algebraically and geometrically. They will help us simplify the statements of problems and theorems and to find solutions and proofs. Determinants measure volumes and areas.

Detailed Contents:

Section-A

Unit-I: Linear Algebra: Matrices, Vectors, Determinants, Linear Systems (15 hours) Matrices, Vectors: Addition and Scalar Multiplication, Matrix Multiplication, Linear Systems of Equations, Linear Independence. Rank of a Matrix. Vector Space, Solutions of Linear Systems: Existence, Uniqueness, Determinants, Cramer's Rule, Inverse of a Matrix. Gauss Elimination and Gauss-Jordan methods.

Unit-II: Linear Algebra: Matrix Eigenvalue Problems (10 hours)

Eigenvalues, Eigenvectors, Applications of Eigenvalue Problems, Symmetric, Skew-Symmetric, and Orthogonal Matrices

Section-B

Unit-III: Vector Differential Calculus. Grad, Div, Curl (13 hours)

Vectors in 2-Space and 3-Space, Inner Product (Dot Product), Vector Product (Cross Product), Vector and Scalar Functions and Fields, Derivatives, Curves. Arc Length. Curvature, Gradient of a Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field.

Unit-IV: Integral Calculus. Integral Theorems (12 hours):

Line Integrals, Path Independence of Line Integrals, Green's Theorem in the Plane, Surfaces for Surface integrals.

Suggested Text/Reference Books

G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.

Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.

D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.

B. V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11^{th} Reprint, 2010.

N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.

V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.

Course Outcomes: The students will be able to

- Learn to manipulate how to use matrices to sole linear system of equations.
- Use vectors in various mathematical problems which arise in kinematics.

BTAM206-18	**Mathematics-II**	**4L:1T:0P**	**5 Credits**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in integral transform and differential equations. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Detailed Contents:

Section-A

Unit-I: Integral Transforms (10 hours)

Laplace Transforms, Inverse Laplace transforms, Fourier Series, half range Sine and Cosine series, Fourier transforms.

Unit-II: First-Order and second order linear ODEs (15 hours)

Basic Concepts, Solutions of separable ODEs, Exact ODEs, Linear ODEs, Solving ODEs by Laplace Transforms.

Homogeneous Linear ODEs of Second Order, Euler-Cauchy Equations, Wronskian, Nonhomogeneous ODEs, Solution by method of variation of Parameters

Section-B

Unit-III: Series Solutions of ODEs, Special Functions (15 hours)

Power Series Method, Legendre.'s Equation, Legendre Polynomials, Bessel's Equation, Bessel Functions, Sturm-Liouville boundary Problems, Orthogonal Functions

Unit-IV: Partial Differential Equations (10 hours)

Basic Concepts, Classification, Solution of PDEs: Separation of Variables, with the help of Fourier Series and Laplace Transforms.

Text Books/ Reference Books:

D. Poole, “Linear Algebra: A Modern Introduction”, Brooks/Cole, 2005.

N.P. Bali and M. Goyal, “A text book of Engineering Mathematics”, Laxmi Publications, 2008.

B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, 2010.

V. Krishnamurthy, V. P. Mainra and J. L. Arora, “An introduction to Linear Algebra”, Affiliated East-West press, 2005.

Course Outcomes: Students will be able to:

- demonstrate knowledge of a range of applications of these methods
- understand how integral transforms can be used to solve a variety of differential equations
- develop their attitude towards problem solving.
- Understand how to apply integral transforms to solve the mathematical models.

Branch/Course: BIOTECHNOLOGY ENGINEERING

BTAM107-18	**Basic Mathematics-I**	**4L:1T:0P**	**5 Credits**

Course Objectives: The objective of this course is to familiarize the students with the basic techniques of mathematics which are highly useful to solve simple problems. This introduction aims at making the students understand the basic concepts in mathematics.

Detailed Contents:

Section-A

Unit-I: Algebra (12 hours)

Complex numbers, Solution of quadratic equations, Permutations and combinations, Binomial theorem for positive/negative index and its simple applications, Arithmetic and geometric progression.

Unit-II: Trigonometry (13 hours)

Review of trigonometric functions, Sum and product formulae for trigonometric functions, Trigonometric equations and sum - to - product formulae for trigonometric functions, Identities related to double angle formulae.

Section-B

Unit-III: Determinants and Matrices (12 hours)

Matrices, Operations on matrices, Determinants and its properties, Singular and non-singular matrices, Adjoint and inverse of a matrix and its properties, Solution of system of linear equations using Cramer's rule and matrix method.

Unit-IV: Coordinate Geometry and Statistics (13 hours)

Rectangular coordinate system, Straight lines, Circles (in standard form only).

Measure of dispersion: mean deviation, Variance and standard deviation of grouped/ungrouped data. Correlation and regression.

Text books/Reference Books:

1) Mathematics, A Text books (Parts I & II), NCERT, New Delhi 2011.

2) E. Kreyszig, Advanced Engineering Mathematics, John Wiley, 1999.

3) V.K. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Associated East West Press 2007.

4) S.L. Loney, The elements of Coordinate Geometry, Michigan Historical Reprint series, 2012.

5) P.L. Meyer, Introductory Probability and Statistical Applications, Addison Wesley 1970.

Course Outcomes: Students will be able to

- acquire knowledge of basic algebra, trigonometry, matrices, coordinate geometry etc.
- apply these concepts to solve complex mathematical problems
- analyze the data of any experiment statistically to extract meaningful result

BTAM207-18	**Basic Mathematics-II**	**4L:1T:0P**	**5 credits**

Course Objectives: The objective is to develop basic computing skills and application of quantitative required for biological studies and rationalization of experimental designs.

Detailed Contents:

Section-A

Unit-I: Differentiation (12 hours)

Functions, Domain and range, Properties of standard functions (trigonometric, exponential and logarithmic) and their graphs, Limit, Continuity and Differentiability. Differentiation of standard functions (polynomials, trigonometric, inverse trigonometric exponentials and logarithmic), Product rule, Quotient rule, Chain rule.

Unit-II: Applications of derivatives (13 hours)

Applications of derivatives in graphing, Maximum and minimum of single variable function, Functions of several variables, Partial derivatives, Homogeneous functions, Maximum and minimum of several variable functions.

Section-B

Unit-III: Integration (12 hours)

Integral as anti-derivative, Integration: by substitution, by parts and partial fractions, Definite integral and its properties, Double integrals, Areas of bounded regions and rectification.

Unit-IV: Differential Equations (13 hours)

Order and degree, General and particular solution of differential equation, Techniques for solving first order ordinary differential equation and its applications to biological problems (population growth, radioactive decay).

Text books/Reference Books:

1. Mathematics, A Text books (Parts I & II), NCERT, New Delhi, 2011.

2. G.B. Thomas and R.L. Finney, Calculus and Analytical Geometry, Pearson Education, 10th ed., 2007.

3. E. Kreyszig, Advanced Engineering Mathematics, 8th Edition, John Wiley, 1999.

4. Shanti Narayan, Differential and Integral Calculus, S. Chand, 2005.

Course Outcomes: Students will be able:

- explain functions, related properties and determine their continuity and differentiability.
- apply derivatives in graphing and maxima and minima of single variable function.
- predict integration of function using by parts, by substitution and partial fraction methods and apply these to find areas of bounded regions and rectifications.
- learn methods to solve first order ordinary differential equations and apply it to biological problems

Category	Engineering Science Course				
Course title	**Basic Electrical Engineering (Theory & Lab.)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester –I/II
	3	**1**	**2**	**5**	
Pre-requisites (if any): Nil					

Course code: BTEE-101-18
Course Title: Basic Electrical Engineering **(4 credits)**
[L: 3; T:1; P : 0]
Internal Marks: 40 External Marks: 60 Total Marks: 100
Course Outcomes:
At the end of this course, students will:

CO 1	Have the knowledge of DC circuits, AC Circuits, basic magnetic circuits, working principles of electrical machines, and components of low voltage electrical installations
CO 2	Be able to analyze of DC circuits, AC Circuits
CO 3	Understand the basic magnetic circuits and apply it to the working of electrical machines
CO 4	Be introduced to types of wiring, batteries, and LT switchgear.

Detailed contents:

Module 1: DC Circuits (9 hours)

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin's and Norton's Theorems. Time-domain analysis of first-order RL and RC circuits.

Module 2: AC Circuits (9 hours)

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

Module 3: Electrical Machines (16 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor.

Construction, working, torque-speed characteristic and speed control of separately excited dc motor. Construction and working of synchronous generators.

Module 4: Electrical Installations (7 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), Miniature Circuit Breaker (MCB), Earth Leakage Circuit Breaker (ELCB), MCCB, Contactors, Types of Wires and Cables, Earthing. Types of Batteries, Important Characteristics for Batteries. Elementary calculations for energy consumption, power factor improvement and battery backup.

Suggested Text / Reference Books

D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
T.K. Nagsarkar and M.S. Sukhija, “Basic Electrical Engineering”, Oxford University Press
D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
B. L. Theraja, “Electrical Technology”, S Chand Publishing
J. B. Gupta, “Basic Electrical Engineering”, S.K. Kataria & Sons

Course code: BTEE-102-18
Course Title: Basic Electrical Engineering Laboratory **(1 credit)**

[L: 0; T:0; P : 2]
Internal Marks: 30 External Marks: 20 Total Marks: 50

List of experiments/demonstrations:

- Basic safety precautions. Introduction and use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.

- Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope). Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification. Observation of phase differences between current and voltage. Resonance in R-L-C circuits.

- Transformers: Observation of the no-load current waveform on an oscilloscope (non-sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.

- Three-phase transformers: Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-to-neutral voltage, line and phase currents). Phase-shifts between the primary and secondary side. Cumulative three-phase power in balanced three-phase circuits.
- Demonstrate of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winging - slip ring arrangement) and single-phase induction machine.
- Torque Speed Characteristic of separately excited dc motor.

- Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections. Torque-Slip Characteristic of an induction motor. Generator operation of an induction machine driven at super-synchronous speed.

- Synchronous Machine operating as a generator: stand-alone operation with a load. Control of voltage through field excitation.

Laboratory Outcomes

CO 1	The ability to use common electrical measuring instruments and understand the fundamentals of electrical engineering.
CO 2	The ability to make electrical connections, and measure power, power factor using appropriate equipments.
CO 3	Have the knowledge of electrical machines, components and their ratings.
CO 4	Understand the operation of transformers and electrical machines.

S. No.	Suggested List of Experiments
1.	To verify Ohm's Law and its limitations.
2.	To verify Kirchhoff's Laws.
3.	To measure the resistance and inductance of a coil by ammeter-voltmeter method
4.	To find voltage-current relationship in a R-L series circuit and to determine the power factor of the circuit.
5.	To verify the voltage and current relations in star and delta connected systems.
6.	To measure power and power factor in a single- phase AC circuit.
7.	To verify series and parallel resonance in AC circuits.
8.	To observe the B-H loop of ferromagnetic core material on CRO.
9.	To use a bridge rectifier for full- wave rectification of AC supply and to determine the relationship between RMS and average values of the rectified voltage.
10.	To measure the minimum operating voltage, current drawn, power consumed, and the power factor of a fluorescent tube light, Bulb, Single phase induction motor,
11.	To connect measuring analog and digital instruments to measure current, voltage, power and power factor.

12.	To perform open- and short circuit tests on a single- phase transformer and calculate its efficiency.
13.	To start and reverse the direction of rotation of a (i) DC motor (ii) three phase Induction motor
14.	Study of starters for (i) DC motor (ii) Induction motor
15.	Study of Cut section of DC Series motor, DC shunt motor and three phase induction motor
16.	Calibration of energy meter.

Note: A student to perform any 8-10 Experiments from the above list.

Course code	BTME101-18				
Category	Engineering Science Courses				
Course title	Engineering Graphics & Design (Theory & Lab.)				
Scheme and Credits	L	T	P	Credits	Semester – I
	1	0	4	3	
Pre-requisites (if any)	-				
	Common to all branches				

Engineering Graphics & Design [A total of 10 lecture hours & 60 hours of lab.]
[[L : 1; T:0; P : 4 (3 credits)]

Detailed contents

Traditional Engineering Graphics:
Principles of Engineering Graphics; Orthographic Projection; Descriptive Geometry; Drawing Principles; Isometric Projection; Surface Development; Perspective; Reading a Drawing; Sectional Views; Dimensioning & Tolerances; True Length, Angle; intersection, Shortest Distance.
Computer Graphics:
Engineering Graphics Software; -Spatial Transformations; Orthographic Projections; Model Viewing; Co-ordinate Systems; Multi-view Projection; Exploded Assembly; Model Viewing; Animation; Spatial Manipulation; Surface Modelling; Solid Modelling; Introduction to Building Information Modelling (BIM)

(Except the basic essential concepts, most of the teaching part can happen concurrently in the laboratory)

Module 1: Introduction to Engineering Drawing covering,
Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales;

Module 2: Orthographic Projections covering,
Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Planes;

Module 3: Projections of Regular Solids covering,
those inclined to both the Planes- Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Module 4:Sections and Sectional Views of Right Angular Solids covering,
Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Module 5: Isometric Projections covering,

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions;

Module 6: Overview of Computer Graphics covering,
listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; Isometric Views of lines, Planes, Simple and compound Solids];

Module 7: Customisation & CAD Drawing
consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Module 8: Annotations, layering & other functions covering
applying dimensions to objects, applying annotations to drawings; Setting up and use of layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques; Drawing sectional views of composite right regular geometric solids and project the true shape of the sectioned surface; Drawing annotation, Computer-aided design (CAD) software modeling of parts and assemblies. Parametric and non-parametric solid, surface, and wireframe models. Part editing and two-dimensional documentation of models. Planar projection theory, including sketching of perspective, isometric, multiview, auxiliary, and section views. Spatial visualization exercises. Dimensioning guidelines, tolerancing techniques; dimensioning and scale multi views of dwelling;

Module 9: Demonstration of a simple team design project that illustrates
Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; meshed topologies for engineering analysis and tool-path generation for component manufacture; geometric dimensioning and tolerancing; Use of solid-modeling software for creating associative models at the component and assembly levels; floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc. Applying colour coding according to building drawing practice; Drawing sectional elevation showing foundation to ceiling; Introduction to Building Information Modelling (BIM).

Suggested Text/Reference Books:

(i) Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
(ii) Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
(iii) Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
(iv) Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers
(v) (Corresponding set of) CAD Software Theory and User Manuals Course Outcomes

Course Outcomes

All phases of manufacturing or construction require the conversion of new ideas and design concepts into the basic line language of graphics. Therefore, there are many areas (civil, mechanical, electrical, architectural and industrial) in which the skills of the CAD technicians play major roles in the design and development of new products or construction. Students prepare for actual work situations through practical training in a new state-of-the-art computer designed CAD laboratory using engineering software. This course is designed toaddress:

- to prepare you to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- to prepare you to communicate effectively
- to prepare you to use the techniques, skills, and modern engineering tools necessary for engineering practice

The student will learn :

- Introduction to engineering design and its place in society
- Exposure to the visual aspects of engineering design
- Exposure to engineering graphics standards
- Exposure to solid modelling
- Exposure to computer-aided geometric design
- Exposure to creating working drawings
- Exposure to engineering communication

Paper Title : Engineering Graphics & Design (Practical)

Course Assessment Methods

End Semester Assessment:

1. University Theory Exam: Nil
2. University Practical Exam: 40 Marks (Evaluation of Traditional Engineering Graphics part of 20 Marks should be based upon written test by External Practical Examiner & Evaluation of Computer Graphics part of 20 marks should be based upon lab performance using computer graphics software & viva voce by External Practical Examiner)

Internal Assessment:

1. 60 Marks (20 marks for day to day work, 20 marks for written test & 20 marks for internal viva voce)

Semester 2nd

Course code	**BTCH101-18**				
Category	**Basic Science Course**				
Course title	**Chemistry-I (Theory)**				
	<u>Contents</u>				
	(i) Chemistry-I (Concepts in chemistry for engineering)				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester –II**
	3	**1**	**0**	**4**	
Pre-requisites (if any)	**-**				

(i) Chemistry-I (Concepts in chemistry for engineering) [L : 3; T:1; P : 0 (4 credits)]

<u>Detailed contents</u>

(i) Atomic and molecular structure (12 lectures)

Schrodinger equation. Particle in a box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicenter orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomic. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H_3, H_2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion.

Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry and chirality, enantiomers, diastereomers, optical activity, absolute configurations and conformational analysis. Isomerism in transitional metal compounds

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R.A. Plane
(iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure and Function by K. P. C. Volhardt and N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10+2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications.

Quantum theory is more than 100 years old and to understand phenomena at nanometer levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques.
- Rationalise periodic properties such as ionization potential, electronegativity, oxidation states and electronegativity.
- List major chemical reactions that are used in the synthesis of molecules.

Course code	**BTCH102-18**				
Category	**Basic Science Course**				
Course title	**Chemistry-I (Lab.)**				
	Contents				
	(ii) Chemistry Laboratory				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester –II**
	0	**0**	**3**	**1.5**	
Pre-requisites (if any)	**-**				

(ii) Chemistry Laboratory [L : 0; T:0 ; P : 3 (1.5 credits)]

Choice of 10-12 experiments from the following

- Determination of surface tension and viscosity
- Thin Layer Chromatography
- Ion exchange column for removal of hardness of water
- Colligative properties using freezing point depression
- Determination of the rate constant of a reaction
- Determination of cell constant and conductance of solutions
- Potentiometry-determination of redox potentials and emf
- Synthesis of a polymer/drug
- Saponification/acid value of an oil
- Chemical analysis of a salt
- Lattice structures and packing of spheres
- Models of potential energy surfaces
- Chemical oscillations- Iodine clock reaction
- Determination of the partition coefficient of a substance between two immiscible liquids
- Adsorption of acetic acid by charcoal
- Use of the capillary viscometers to the demonstrate of the isoelectric point as the pH of minimum viscosity for gelatin sols and/or coagulation of the white part of egg.

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials, chloride content of water, etc
- Synthesize a small drug molecule and analyse a salt sample

<table>
<tr><td>Course code</td><td colspan="5">BTPS101-18</td></tr>
<tr><td>Category</td><td colspan="5">Engineering Science Course</td></tr>
<tr><td>Course title</td><td colspan="5">Programming for Problem Solving (Theory)</td></tr>
<tr><td rowspan="2">Scheme and Credits</td><td>L</td><td>T</td><td>P</td><td>Credits</td><td rowspan="2">Semester – II
[The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisites (if any)</td><td colspan="5">-</td></tr>
</table>

(i) Programming for Problem Solving ([L : 3; T:0; P : 0 (3 credits)] [contact hrs : 40]

Detailed contents

Unit 1

Introduction to Programming **(4 lectures)**

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.) – **(1 lecture).**

Idea of Algorithm: steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/Pseudocode with examples. **(1 lecture)**

From algorithms to programs; source code, variables (with data types) variables and memory locations, Syntax and Logical Errors in compilation, object and executable code- **(2 lectures)**

Unit 2

Arithmetic expressions and precedence **(2 lectures)**
Conditional Branching and Loops **(6 lectures)**
Writing and evaluation of conditionals and consequent branching **(3 lectures)**
Iteration and loops **(3 lectures)**

Unit 3

Arrays **(6 lectures)**
Arrays (1-D, 2-D), Character arrays and Strings

Unit 4

Basic Algorithms **(6 lectures)**
Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit 5

Function **(5 lectures)**

Functions (including using built in libraries), Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference

Unit 6

Recursion **(4 -5 lectures)**

Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit 7

Structure **(4 lectures)**

Structures, Defining structures and Array of Structures

Unit 8

Pointers **(2 lectures)**

Idea of pointers, Defining pointers, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit 9

File handling (only if time is available, otherwise should be done as part of the lab)

Suggested Text Books

(i) Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill

(ii) E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

Suggested Reference Books

(i) Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India.

Course Outcomes

The student will learn

To formulate simple algorithms for arithmetic and logical problems.

To translate the algorithms to programs (in C language).

To test and execute the programs and correct syntax and logical errors.

To implement conditional branching, iteration and recursion.

To decompose a problem into functions and synthesize a complete program using divide and conquer approach.

To use arrays, pointers and structures to formulate algorithms and programs.

To apply programming to solve matrix addition and multiplication problems and searching and sorting problems.

To apply programming to solve simple numerical method problems, namely rot finding of function, differentiation of function and simple integration.

Course code	BTPS102-18				
Category	Engineering Science Course				
Course title	**Programming for Problem Solving (Lab)**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	Semester – II [The lab component should have one hour of tutorial followed or preceded by laboratory assignments.]
	0	**0**	**4**	**2**	
Pre-requisites (if any)	**-**				

(ii) Laboratory - Programming for Problem Solving [L : 0; T:0 ; P : 4 (2credits)]
[The laboratory should be preceded or followed by a tutorial to explain the approach or algorithm to be implemented for the problem given.]

Tutorial 1: Problem solving using computers:
Lab1: Familiarization with programming environment

Tutorial 2: Variable types and type conversions:
Lab 2: Simple computational problems using arithmetic expressions

Tutorial 3: Branching and logical expressions:
Lab 3: Problems involving if-then-else structures

Tutorial 4: Loops, while and for loops:
Lab 4: Iterative problems e.g., sum of series

Tutorial 5: 1D Arrays: searching, sorting:
Lab 5: 1D Array manipulation

Tutorial 6: 2D arrays and Strings
Lab 6: Matrix problems, String operations

Tutorial 7: Functions, call by value:
Lab 7: Simple functions

Tutorial 8 &9: Numerical methods (Root finding, numerical differentiation, numerical integration):
Lab 8 and 9: Programming for solving Numerical methods problems

Tutorial 10: Recursion, structure of recursive calls
Lab 10: Recursive functions

Tutorial 11: Pointers, structures and dynamic memory allocation
Lab 11: Pointers and structures

Tutorial 12: File handling:
Lab 12: File operations

Laboratory Outcomes

To formulate the algorithms for simple problems
To translate given algorithms to a working and correct program
To be able to correct syntax errors as reported by the compilers
To be able to identify and correct logical errors encountered at run time
To be able to write iterative as well as recursive programs
To be able to represent data in arrays, strings and structures and manipulate them through a program
To be able to declare pointers of different types and use them in defining self referential structures.
To be able to create, read and write to and from simple text files.

Course code	BTMP101-18				
Category	Engineering Science Courses				
Course title	Workshop/Manufacturing Practices (Theory & Lab.)				
Scheme and Credits	L	T	P	Credits	Semester-II
	1	0	4	3	
Pre-requisites (if any)	-				
	Common to all branches				

Workshop/Manufacturing Practices [[L : 1; T:0; P : 0 (1 credit)]
Lectures & videos: (10 hours)

Detailed contents

1. Manufacturing Methods- casting, forming, machining, joining, advanced manufacturing methods (3 lectures)
2. CNC machining, Additive manufacturing (1 lecture)
3. Fitting operations & power tools (1 lecture)
4. Electrical &Electronics (1 lecture)
5. Carpentry (1 lecture)
6. Plastic moulding, glass cutting (1 lecture)
7. Metal casting (1 lecture)
8. Welding (arc welding & gas welding), brazing (1 lecture)

Suggested Text/Reference Books:

(i) Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K., " Elements of Workshop Technology" , Vol. I 2008 and Vol. II 2010, Media promoters and publishers private limited, Mumbai.
(ii) Kalpakjian S. And Steven S. Schmid, " Manufacturing Engineering and Technology" , 4th edition, Pearson Education India Edition, 2002.
(iii) Gowri P. Hariharan and A. Suresh Babu," Manufacturing Technology – I" Pearson Education, 2008.
(iv) Roy A. Lindberg, " Processes and Materials of Manufacture", 4th edition, Prentice Hall India, 1998.
(v) Rao P.N., " Manufacturing Technology" , Vol. I and Vol. II, Tata McGrawHill House, 2017.

Course Outcomes

Upon completion of this course, the students will gain knowledge of the different manufacturing processes which are commonly employed in the industry, to fabricate components using different materials.

(ii) Workshop Practice:(60 hours)[L : 0; T:0 ; P : 4 (2 credits)]

1. Machine shop (10 hours)
2. Fitting shop (8 hours)
3. Carpentry (6 hours)
4. Electrical & Electronics(8 hours)
5. Welding shop (8 hours (Arc welding 4 hrs + gas welding 4 hrs)
6. Casting (8 hours)
7. Smithy (6 hours)
8. Plastic moulding& Glass Cutting (6 hours)

Examinations could involve the actual fabrication of simple components, utilizing one or more of the techniques covered above.

Laboratory Outcomes

- Upon completion of this laboratory course, students will be able to fabricate components with their own hands.
- They will also get practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.
- By assembling different components, they will be able to produce small devices of their interest.

BTHU-101-18 English 2L: 0T: 0P 2 credits

Course Outcomes:

- The objective of the course is to help the students become the independent users of English language.
- Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.
- Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.
- They will be able to converse fluently.
- They will be able to produce on their own clear and coherent texts.

Detailed contents

Unit-1 Vocabulary Building & Basic Writing Skills

- The concept of Word Formation
- Root words from foreign languages and their use in English
- Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives.
- Synonyms, antonyms, and standard abbreviations.
- Sentence Structures
- Use of phrases and clauses in sentences
- Importance of proper punctuation
- Creating coherence
- Organizing principles of paragraphs in documents
- Techniques for writing precisely

Unit-2 Identifying Common Errors in Writing

- Subject-verb agreement
- Noun-pronoun agreement
- Misplaced modifiers
- Articles
- Prepositions
- Redundancies

- Clichés

Unit-3 Mechanics of Writing

- Writing introduction and conclusion
- Describing
- Defining
- Classifying
- Providing examples or evidence

Unit-4 Writing Practices

- Comprehension
- Précis Writing
- Essay Writing
- Business Writing-Business letters, Business Emails, Report Writing, Resume/CV

Suggested Readings:

(i) *Practical English Usage*. Michael Swan. OUP. 1995.

(ii) *Remedial English Grammar*. F.T. Wood. Macmillan.2007

(iii) *On Writing Well*. William Zinsser. Harper Resource Book. 2001

(iv) *Study Writing*. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

(v) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

(vi) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

BTHU-102-18 (English Laboratory)

0L: 0T: 2P 1 credit

Course Outcomes:

- The objective of the course is to help the students become the independent users of English language.
- Students will acquire basic proficiency in listening and speaking skills.
- Students will be able to understand spoken English language, particularly the language of their chosen technical field.
- They will be able to converse fluently
- They will be able to produce on their own clear and coherent texts.

Detailed contents

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self-Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Suggested Readings:

(i) *Practical English Usage*. Michael Swan. OUP. 1995.

(ii) *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.

(iii) *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Scheme & Syllabus of

Bachelor of Computer Applications (BCA)

Batch 2019 onwards

By

Board of Study Computer Applications

Department of Academics

IK Gujral Punjab Technical University

DEPUTY DIRECTOR
IKGPTU CAMPUS HOSHIARPUR

Bachelors of Computer Applications (BCA):
It is a Under Graduate (UG) Programme of 3 years duration (6 semesters)

Eligibility: All those candidates who have passed the 10+2 or its equivalent examination in any stream conducted by a recognized Board / University / Council.

Or

Those candidates who have passed their Matriculation examination **AND** have also passed three year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or Sant Longowal Institute of Engineering & Technology, Longowal.

BCA (Lateral Entry): It is a Under Graduate (UG) Programme of 2 years duration (4 semesters)
Eligibility: All those candidates who have passed Matriculation examination **AND** have also passed 3 Year Diploma in any Trade from Punjab State Board of Technical Education & Industrial Training, Chandigarh or such Examination from any other recognized State Board of Technical Education, or Sant Longowal Institute of Engineering & Technology, Longowal.

Or

10+2 with 1 year Diploma in Computer Application / IT (or equivalent) from a recognized University with Mathematics as course at 10+2 or DIT / DCA level.

DEPUTY DIRECTOR
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I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

PROGRAM OUTCOMES (POs)

Program: BCA

1. **Basic knowledge:** An ability to apply knowledge of basic mathematics, science and domain knowledge to solve the computational problems.

2. **Discipline knowledge**: An ability to apply discipline –specific knowledge to solve core and/or applied computational problems.

3. **Experiments and practice:** An ability to plan and perform experiments and practices and to use the results to solve computational problems.

4. **Tools Usage**: Apply appropriate technologies and tools with an understanding of limitations.

5. **Profession and society**: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional practice.

6. **Environment and sustainability**: Understand the impact of the computational solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the professional practice.

8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

9. **Communication:** An ability to communicate effectively.

10. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

First Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1901	Core Theory	Mathematics	3	1	0	40	60	100	4
UGCA1902	Core Theory	Fundamentals of Computer and IT	3	1	0	40	60	100	4
UGCA1903	Core Theory	Problem Solving using C	3	1	0	40	60	100	4
UGCA1904	Practical/Laboratory	Workshop on Desktop Publishing	0	0	4	60	40	100	2
UGCA1905	Core Practical/Laboratory	Problem Solving using C Laboratory	0	0	4	60	40	100	2
UGCA1906	Core Practical/Laboratory	Fundamentals of Computer and IT Laboratory	0	0	4	60	40	100	2
BTHU103/18	Ability Enhancement Compulsory Course (AECC)-I	English	1	0	0	40	60	100	1
BTHU104/18	Ability Enhancement Compulsory Course (AECC)	English Practical/Laboratory	0	0	2	30	20	50	1
HVPE101-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules	3	0	0	40	60	100	3
HVPE102-18	Ability Enhancement Compulsory Course (AECC)	Human Values, De-addiction and Traffic Rules (Lab/ Seminar)	0	0	1	25	--**	25	1
BMPD102-18		Mentoring and Professional Development	0	0	1	25	--**	25	1
	TOTAL		**13**	**3**	**16**	**460**	**440**	**900**	**25**

The Human Values, De-addiction and Traffic Rules (Lab/ Seminar) and Mentoring and Professional Development course will have internal evaluation only. **(See guidelines at the last page of this file)

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Second Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1907	Core Theory	Fundamentals of Statistics	3	1	0	40	60	100	4
UGCA1908	Core Theory	Computer System Architecture	3	1	0	40	60	100	4
UGCA1909	Core Theory	Object Oriented Programming using C++	3	1	0	40	60	100	4
UGCA1910	Core Practical/Laboratory	Object Oriented Programming using C++ Laboratory	0	0	4	60	40	100	2
UGCA1911	Core Practical/Laboratory	Fundamentals of Statistics Laboratory	0	0	4	60	40	100	2
UGCA1912	Core Practical/Laboratory	Computer System Architecture Laboratory	0	0	4	60	40	100	2
EVS102-18	Ability Enhancement Compulsory Course (AECC) -III	Environmental Studies	2	0	0	40	60	100	2
BMPD202-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**11**	**3**	**13**	**365**	**360**	**725**	**21**

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Third Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1913	Core Theory	Computer Networks	3	1	0	40	60	100	4
UGCA1914	Core Theory	Programming in Python	3	1	0	40	60	100	4
UGCA1915	Core Theory	Data Structures	3	1	0	40	60	100	4
UGCA1916	Core Practical/Laboratory	Computer Networks Laboratory	0	0	4	60	40	100	2
UGCA1917	Core Practical/Laboratory	Programming in Python Laboratory	0	0	4	60	40	100	2
UGCA1918	Core Practical/Laboratory	Data Structures Laboratory	0	0	4	60	40	100	2
UGCA1919	Skill Enhancement Course-I	PC Assembly & Troubleshooting	3	0	0	40	60	100	3
UGCA1920	Skill Enhancement Course- Laboratory	PC Assembly & Troubleshooting Laboratory	0	0	2	30	20	50	1
BMPD302-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**3**	**15**	**395**	**380**	**775**	**23**

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Fourth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1921	Core Theory	Software Engineering	3	1	0	40	60	100	4
UGCA1922	Core Theory	Database Management Systems	3	1	0	40	60	100	4
UGCA1923	Core Theory	Operating Systems	3	1	0	40	60	100	4
UGCA1924	Core Practical/Laboratory	Software Engineering Laboratory	0	0	4	60	40	100	2
UGCA1925	Core Practical/Laboratory	Database Management Systems Laboratory	0	0	4	60	40	100	2
UGCA1926	Core Practical/Laboratory	Operating Systems Laboratory	0	0	4	60	40	100	2
UGCA1927	Skill Enhancement Course-II	Web Designing	3	0	0	40	60	100	3
UGCA1928	Skill Enhancement Course- Laboratory	Web Designing Laboratory	0	0	2	30	20	50	1
BMPD402-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**03**	**15**	**395**	**380**	**775**	**23**

Students will undergo 4 weeks Institutional Summer Training* after 4th semester. Examination will be conducted along with 5th semester practical.

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Fifth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1929	Skill Enhancement Course-III	Programming in PHP	3	0	0	40	60	100	3
UGCA1930	Skill Enhancement Course-Laboratory	Programming in PHP Laboratory	0	0	2	30	20	50	1
	Open Elective-I		3	1	0	40	60	100	4
	Elective-I		3	1	0	40	60	100	4
	Elective-II		3	1	0	40	60	100	4
	Elective-I Laboratory		0	0	4	60	40	100	2
	Elective-II Laboratory		0	0	4	60	40	100	2
	Project	Minor Project	0	0	2	60	40	100	1
	Institutional Summer Training*		0	0	2	60	40	100	1
BMPD502-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**12**	**03**	**15**	**455**	**420**	**875**	**23**

Elective -I	
Course Code	Course Title
UGCA1931	Data Warehouse and Mining
UGCA1932	Programming in Java
UGCA1933	Internet of Things

Elective -II	
Course Code	Course Title
UGCA1934	Computer Graphics
UGCA1935	Linux Operating System
UGCA1936	Cloud Computing

Elective-I Laboratory	
Course Code	Course Title
UGCA1937	Data Warehouse and Mining Laboratory
UGCA1938	Programming in Java Laboratory
UGCA1939	Internet of Things Laboratory

Elective-II Laboratory	
Course Code	Course Title
UGCA1940	Computer Graphics Laboratory
UGCA1941	Linux Operating System Laboratory
UGCA1942	Cloud Computing Laboratory

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Sixth Semester

Course Code	Course Type	Course Title	Load Allocation			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
UGCA1943	Skill Enhancement Course-IV	Android Programming	3	0	0	40	60	100	3
UGCA1944	Skill Enhancement Course-Laboratory	Android Programming Laboratory	0	0	2	30	20	50	1
	Open Elective-II		3	1	0	40	60	100	4
	Elective-III		3	1	0	40	60	100	4
	Elective-IV		3	1	0	40	60	100	4
	Elective-III Laboratory		0	0	4	60	40	100	2
	Elective-IV Laboratory		0	0	4	60	40	100	2
	Project	Major Project	0	0	4	120	80	200	4
BMPD602-18		Mentoring and Professional Development	0	0	1	25	--	25	1
	TOTAL		**10**	**03**	**15**	**455**	**485**	**875**	**25**

Elective -III	
Course Code	**Course Title**
UGCA1945	Artificial Intelligence
UGCA1946	R Programming
UGCA1947	Digital Marketing

Elective -IV	
Course Code	**Course Title**
UGCA1948	Information Security
UGCA1949	Cyber Laws & IPR
UGCA1950	Machine Learning

Elective -III	
Course Code	**Course Title**
UGCA1951	Artificial Intelligence Laboratory
UGCA1952	R Programming Laboratory
UGCA1953	Digital Marketing Laboratory

Elective -IV	
Course Code	**Course Title**
UGCA1954	Information Security Laboratory
UGCA1955	Cyber Laws & IPR Laboratory
UGCA1956	Machine Learning Laboratory

Open Electives	
Course Code	**Course Title**
UGCA1902	Fundamentals of Computer and IT
UGCA1903	Problem Solving using C
UGCA1909	Object Oriented Programming using C++
UGCA1913	Computer Networks
UGCA1922	Database Management Systems
UGCA1957	Software Project Management

***The above list of Open Elective Courses is particularly designed to offer to other disciplines such as Physics, Chemistry, Mathematics, Management or any other area of expertise in their Under-Graduate Programs.**

***In case Open Elective-I and Open Elective-II are not offered by any other discipline/branch in the Institute/College, then student may opt Open Elective courses from given lists of Elective courses (Theory only).**

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Bachelor of Computer Applications (BCA)

Course Code: UGCA1901
Course Name: Mathematics

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status: core/elective:** Core

Prerequisite: Student must have the knowledge of Basic Mathematics.
Co requisite: NA.
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.
Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Represent data using various mathematical notions.
CO2	Explain different terms used in basic mathematics.
CO3	Describe various operations and formulas used to solve mathematical problems.

Detailed contents	Contact hours
Unit-I Set Introduction, Objectives, Representation of Sets (Roster Method, Set Builder Method), Types of Sets (Null Set, Singleton Set, Finite Set, Infinite Set, Equal Set, Equivalent Set, Disjoint Set, Subset, Proper Subset, Power Set, Universal Set) and Operation with Sets (Union of Set, Intersection of Set, Difference of Set, Symmetric Difference of Set) Universal Sets, Complement of a Set.	12 hours
Unit-II Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.	10 hours
Unit -III Matrices Introduction, Types of Matrix (Row Matrix, Column Matrix, Rectangular Matrix, Square Matrix, Diagonal Matrix, Scalar Matrix, Unit Matrix, Null Matrix, Comparable Matrix, Equal Matrix), Scalar Multiplication, Negative of Matrix, Addition of Matrix, Difference of two Matrix, Multiplication of Matrices, Transpose of a Matrix.	12 hours

Unit-IV Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means, Geometric Progression, Geometric Mean.	10 hours

Text Books:

1. Discrete Mathematics and Its Applications by Kenneth H. Rosen, Mc Graw Hill, 6th Edition.
2. College Mathematics, Schaum's Series, TMH.

Reference Books:

1. Elementary Mathematics, Dr. RD Sharma
2. Comprehensive Mathematics, Parmanand Gupta
3. Elements of Mathematics, ML Bhargava

E Books/ Online learning material

1. www.see.leeds.ac.uk/geo-maths/basic_maths.pdf
2. www.britannica.com/science/matrix-mathematics
3. www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html

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Course Code: UGCA1902
Course Name: Fundamentals of Computer and IT

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understanding the concept of input and output devices of Computers
CO2	Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.

CO3	Understand an operating system and its working, and solve common problems related to operating systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.
CO5	Study to use the Internet safely, legally, and responsibly

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. **Functional Units of Computer System:** CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	12
Unit-II **Concept of Computing, Types of Languages:** Machine, assembly and High level Language; Operating system as user interface, utility programs. **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.	10
Unit-III **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	10

Unit-IV **Electronic Payment System:** Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)	12

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Computer Fundamentals, A. Goel, 2010, Pearson Education.
3. Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPB Publishers.
4. IT Tools, R.K. Jain, Khanna Publishing House
5. “Introduction to Information Technology”, Satish Jain, Ambrish Rai & Shashi Singh, Paperback Edition, BPB Publications, 2014.

Reference Books:

1. “Introduction to Computers”, Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. “Computers”, Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in/course/4067-computer-fundamentals

Course Code: UGCA1903
Course Name: Problem Solving using C

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1^{st}	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Student should be able to understand the logic building used in Programming.
CO2	Students should be able to write algorithms for solving various real life problems.
CO3	To convert algorithms into programs using C .

Detailed Contents	Contact hours
Unit-I **Logic Development:** Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.	11
Unit-II **Data Input and Output:** formatted & unformatted input output. **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements.	10
Unit-III **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays. **Strings**: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.	11

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Unit-IV **Structures & Unions:** Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions. **Pointers:** Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays **File Handling:** File Operations, Processing a Data File	12

Text Books:

1. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill.
2. Programming in C, Third Edition, Stephen G Kochan, Pearson.
3. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication.

Reference Books:

1. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
2. Let us C, Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
3. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.
4. Problem Solving and Programming in C, R.S. Salaria, Second Edition
5. Programming in C, Atul Kahate.

Course Code: UGCA1904
Course Name: Workshop on Desktop Publishing

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours**: 4 hours per week
Internal max. marks: 60	**Theory/Practical**: Practical
External max. marks: 40	**Duration of end semester examinations (ESE):** 3hrs
Total marks: 100	**Elective status**: Core

Prerequisite: Students must have basic understanding of designing/ Painting tools.
Co requisite: Printing & Publishing tools.
Additional material required in ESE: Softcopy & Hardcopy of the exercises are to be maintained during the practical labs and to be submitted during the End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course outcomes
CO1	The students will gain professional skills of *Desk Top Publishing* Tools like designing, Printing & Publishing by using various tools.
CO2	Develop skills in printing jobs through basic understanding of a variety of designing tools.
CO3	Apply these concepts and knowledge in designing field including practice from text formatting to final publishing.
CO4	Workshops are included to enhance professional skills like Brochures, Flexes, Business Cards, Certificates and News Letter layouts etc.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Design and print a *Title Page* of a Magazine/Book.
2.	Prepare multiple designs for a *Flex* by using different Tools.
3.	Prepare NSS *Certificates* for appreciation using logos of University, College & NSS unit.
4.	Prepare 5 different Designing of *Business Cards*.
5.	Prepare *Envelops* displaying full address of the company by inserting graphical symbol/ logos of company.
6.	Design and Print *Invoices* for three companies.
7.	Prepare and print *News Letter Layouts* for any five activities of your college/ university.
8.	Prepare *Invitation Cards* for cultural meet held in your college.
9.	Design and print *Brochures* to advertise a “Blood Donation Camp” in your college.
10.	Design *Logos* of your college, University & Govt. of Punjab also display these logos on black background as water mark.
11.	Design, Print and Publish 5 motivations Playcards.
12.	Design & Print assignment book of minimum 20 Pages an any Topic.
13.	Design & Print any five most important activities of your college in a collage.
14.	Design & Print Question Paper of any Subject.
15.	Assemble all the latest news cutting of your activities on a 10 X 8 size flex.

Reference Books:

1. DTP Course, by Shirish Chavan published by Rapidex.
2. DTP Course Kit by Vikas Gupta published by Comdex.
3. CorelDraw 9 by David Karlins published by Techmedia.
4. Adobe Illustrator CC by Brian Wood published by Adobe Press.
5. Page Maker in Easy Steps - Scott Basham.

Software Tools:

1. Adobe Illustrator 14.
2. CorelDraw Graphics Suit.
3. GNU image manipulation program.
4. Ink Scape.
5. PhotoScape Setup.
6. PM701.

Course Code: UGCA1905
Course Name: Problem Solving using C Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 1st	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks:100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course Outcomes
CO1	Students should be able understand the logic building used in programming
CO2	Students should be able to write algorithms for solving various real-life problems
CO3	Students should be able to convert the algorithms into computer programs using C language.

Instructions: Develop all programs in C programming language.

Assignments:

1.	WRITE A PROGRAM to display your name. Write another program to print message with inputted name.
2.	WRITE A PROGRAM to add two numbers.
3.	WRITE A PROGRAM to find the square of a given number.
4.	WRITE A PROGRAM to calculate the average of three real numbers.
5.	Write a program to Find ASCII Value of a Character
6.	WRITE A PROGRAM to Find the Size of int, float, double and char
7.	WRITE A PROGRAM to Compute Quotient and Remainder
8.	WRITE A PROGRAM to accept the values of two variables.

9.	WRITE A PROGRAM to find the simple interest, inputs are amount, period in years and rate of interest.
10.	Basic salary of an employee is input through the keyboard. The DA is 25% of the basic salary while the HRA is 15% of the basic salary. Provident Fund is deducted at the rate of 10% of the gross salary(BS+DA+HRA). WRITE A PROGRAM to calculate the net salary
11.	WRITE A PROGRAM to find area of a circle using PI as constant
12.	WRITE A PROGRAM to find volume of a cube using side as input from user
13.	WRITE A PROGRAM using various unformatted Input Functions
14.	WRITE A PROGRAM to find area of rectangle and print the result using unformatted output Functions
15.	WRITE A PROGRAM to find the larger of two numbers.
16.	WRITE A PROGRAM to find greater of three numbers using Nested If.
17.	WRITE A PROGRAM to find whether the given number is even or odd.
18.	WRITE A PROGRAM to Generate Multiplication Table Using for loop
19.	WRITE A PROGRAM to Generate Multiplication Table Using while loop
20.	WRITE A PROGRAM to Make a Simple Calculator Using switch...case
21.	WRITE A PROGRAM to find whether the given number is a prime number.
22.	WRITE A PROGRAM using function to find the largest of three numbers
23.	WRITE A PROGRAM using function to print first 20 numbers and its squares.
24.	WRITE A PROGRAM to find the factorial of a given number.
25.	WRITE A PROGRAM to print the sum of two matrices
26.	WRITE A PROGRAM to Find the Length of a String
27.	WRITE A PROGRAM to Copy String using strcpy()
28.	WRITE A PROGRAM to compare a string
29.	WRITE A PROGRAM to reverse a string
30.	WRITE A PROGRAM to reverse a string
31.	WRITE A PROGRAM to multiply two numbers using pointers.
32.	WRITE A PROGRAM to display address of variable using pointers
33.	WRITE A PROGRAM to show the memory occupied by Structure and Union
34.	WRITE A PROGRAM to create Student I-Card using a Structure
35.	WRITE A PROGRAM to read data from a file from a file
36.	WRITE A PROGRAM to save Employee details in a file using File Handling

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Course Code: UGCA1906
Course Name: Fundamentals of Computer and IT Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

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Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - NA-

Course Outcomes:

CO#	Course outcomes
CO1	Familiarizing with Open Office (Word processing, Spreadsheets and Presentation).
CO2	To acquire knowledge on editor, spread sheet and presentation software.
CO3	The students will be able to perform documentation and accounting operations.
CO4	Students can learn how to perform presentation skills.

Instructions:

Word Orientation: The instructor needs to give an overview of word processor. Details of the four tasks and features that would be covered Using word – Accessing, overview of toolbars, saving files, Using help and resources, rulers, format painter.	
1.	Using word to create Resume Features to be covered: - Formatting Fonts in word, Drop Cap in word, Applying Text effects, Using Character Spacing, Borders and Colors, Inserting Header and Footer, Using Date and Time option in Word.
2.	Creating an Assignment Features to be covered: - Formatting Styles, Inserting table, Bullets and Numbering, Changing Text Direction, Cell alignment, Footnote, Hyperlink, Symbols, Spell Check, Track Changes.
3.	Creating a Newsletter Features to be covered :- Table of Content, Newspaper columns, Images from files and clipart, Drawing toolbar and Word Art, Formatting Images, Textboxes and Paragraphs
4.	Creating a Feedback form Features to be covered :- Forms, Text Fields, Inserting objects, Mail Merge in Word.
Excel Orientation: The instructor needs to tell the importance of Excel as a Spreadsheet tool, give the details of the four tasks and features that would be covered Excel – Accessing, overview of toolbars, saving excel files,	
1.	Creating a Scheduler Features to be covered :- Gridlines, Format Cells, Summation, auto fill, Formatting Text
2.	Calculations Features to be covered :- Cell Referencing, Formulae in excel – average, std.deviation, Charts, Renaming and Inserting worksheets, Hyper linking, Count function, LOOKUP/VLOOKUP
3.	Performance Analysis

	Features to be covered :- Split cells, freeze panes, group and outline, Sorting, Boolean and logical operators, Conditional formatting
4.	Game (like Cricket, badminton) Score Card Features to be covered :- Pivot Tables, Interactive Buttons, Importing Data, Data Protection, Data Validation
Presentation Orientation:	
1.	Students will be working on basic power point utilities and tools which help them create basic power point presentation. Topic covered includes :- PPT Orientation, Slide Layouts, Inserting Text, Word Art, Formatting Text, Bullets and Numbering, Auto Shapes, Lines and Arrows
2.	This session helps students in making their presentations interactive. Topics covered includes : Hyperlinks, Inserting –Images, Clip Art, Audio, Video, Objects, Tables and Charts
3.	Concentrating on the in and out of Microsoft power point. Helps them learn best practices in designing and preparing power point presentation. Topics covered includes: - Master Layouts (slide, template, and notes), Types of views (basic, presentation, slide slotter, notes etc), Inserting – Background, textures, Design Templates, Hidden slides. Auto content wizard, Slide Transition, Custom Animation, Auto Rehearsing
4.	Power point test would be conducted. Students will be given model power point presentation which needs to be replicated
Internet and its Applications The instructor needs to tell the how to configure Web Browser and to use search engines by defining search criteria using Search Engines	
1.	To learn to setup an e-mail account and send and receive e-mails
2.	To learn to subscribe/post on a blog and to use torrents for accelerated downloads
3.	Hands on experience in online banking and Making an online payment for any domestic bill

Reference Books:

1. IT Tools, R.K. Jain, Khanna Publishing House.
2. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning.

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AECC (For UGC courses)
BTHU103-18 English:

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Detailed Contents:

Unit1- 1 (Introduction)

- Theory of Communication
- Types and modes of Communication

Unit- 2 (Language of Communication)

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

Unit-3 (Reading and Understanding)

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)
  OR
  Precis writing /Paraphrasing (for International Students)
- Literary/Knowledge Texts

Unit-4 (Writing Skills)

- Documenting
- Report Writing
- Making notes

- Letter writing

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. *Language, Literature and Creativity*, Orient Blackswan, 2013.
4. *Language through Literature* (forthcoming) ed. Dr. Gauri Mishra, Dr Ranjana Kaul, Dr Brati Biswas
5. *On Writing Well*. William Zinsser. Harper Resource Book. 2001
6. *Study Writing.* Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.

AECC
BTHU104/18 English Practical/Laboratory
: 0L 0T 2P 1 Credit

Course Outcomes:

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions and business office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

Interactive practice sessions in Language Lab on Oral Communication

- Listening Comprehension
- Self Introduction, Group Discussion and Role Play
- Common Everyday Situations: Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations
- Monologue
- Effective Communication/ Mis- Communication
- Public Speaking

Recommended Readings:

1. *Fluency in English* - Part II, Oxford University Press, 2006.
2. *Business English*, Pearson, 2008.
3. Practical English Usage. Michael Swan. OUP. 1995.
4. *Communication Skills*. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
5. *Exercises in Spoken English*. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

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Course Code: HVPE101-18
Course Name: Human Values, De-addiction and Traffic Rules

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
CO2	To facilitate the development of a Holistic perspective among students towards life, profession and happiness, based on a correct understanding of the Human reality and the rest of Existence. Such a holistic perspective forms the basis of Value based living in a natural way.
CO3	To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually satisfying human behavior and mutually enriching interaction with Nature.

Note: This course is intended to provide a much needed orientational input in Value Education to the young enquiring minds.

Detailed Contents	**Contact hours**
Unit-I **Course Introduction - Need, Basic Guidelines, Content and Process for Value Education**	8

1. Understanding the need, basic guidelines, content and process for Value Education 2. Self-Exploration–what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration 3. Continuous Happiness and Prosperity- A look at basic Human Aspirations 4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority 5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario 6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels	
Unit-II **Understanding Harmony in the Human Being - Harmony in Myself!** 1. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’ *2.* Understanding the needs of Self (‘I’) and ‘Body’ - *Sukh* and *Suvidha* 3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer) 4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’ 5. Understanding the harmony of I with the Body: *Sanyam* and *Swasthya*; correct appraisal of Physical needs, meaning of Prosperity in detail *6.* Programs to ensure *Sanyam* and *Swasthya* - Practice Exercises and Case Studies will be taken up in Practice Sessions.	8
Unit-III **Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship** 1. Understanding harmony in the Family- the basic unit of human interaction 2. Understanding values in human-human relationship; meaning of *Nyaya* and program for its fulfillment to ensure *Ubhay-tripti*; Trust (*Vishwas)* and Respect (*Samman)* as the foundational values of relationship 3. Understanding the meaning of *Vishwas*; Difference between intention and competence 4. Understanding the meaning of *Samman*, Difference between respect and differentiation; the other salient values in relationship	6

5. Understanding the harmony in the society (society being an extension of family): *Samadhan, Samridhi, Abhay, Sah-astitva* as comprehensive Human Goals *6.* Visualizing a universal harmonious order in society- Undivided Society (*Akhand Samaj),* Universal Order (*Sarvabhaum Vyawastha)-* from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.	
Unit-IV **Understanding Harmony in the Nature and Existence - Whole existence as Co-existence** *1.* Understanding the harmony in the Nature *2.* Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature *3.* Understanding Existence as Co-existence (*Sah-astitva*) of mutually interacting units in all-pervasive space *4.* Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.	5
Unit-V **Implications of the above Holistic Understanding of Harmony on Professional Ethics** 1. Natural acceptance of human values 2. Definitiveness of Ethical Human Conduct 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order 4. Competence in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order, b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems. 5. Case studies of typical holistic technologies, management models and production systems 6. Strategy for transition from the present state to Universal Human Order: a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers b) At the level of society: as mutually enriching institutions and organizations.	6

Text Book

1. R R Gaur, R Sangal, G P Bagaria, 2009, *A Foundation Course in Value Education*.

Reference Books

1. Ivan Illich, 1974, *Energy & Equity*, The Trinity Press, Worcester, and Harper Collins, USA.
2. E.F. Schumacher, 1973, *Small is Beautiful: a study of economics as if people mattered*, Blond & Briggs, Britain.
3. A Nagraj, 1998, *Jeevan Vidya ek Parichay*, Divya Path Sansthan, Amarkantak.
4. Sussan George, 1976, How *the Other Half Dies*, Penguin Press. Reprinted 1986, 1991.
5. PL Dhar, RR Gaur, 1990, *Science and Humanism*, Common wealth Publishers.
6. A.N. Tripathy, 2003, *Human Values*, New Age International Publishers.
7. Subhas Palekar, 2000, *How to practice Natural Farming*, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
8. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, *Limits to Growth – Club of Rome's report*, Universe Books.
9. E G Seebauer & Robert L. Berry, 2000, *Fundamentals of Ethics for Scientists & Engineers*, Oxford University Press
10. M Govindrajran, S Natrajan & V.S. Senthil Kumar, *Engineering Ethics (including Human Values)*, Eastern Economy Edition, Prentice Hall of India Ltd.
11. B P Banerjee, 2005, *Foundations of Ethics and Management*, Excel Books.
12. B L Bajpai, 2004, *Indian Ethos and Modern Management*, New Royal Book Co., Lucknow. Reprinted 2008.

Relevant CDs, Movies, Documentaries & Other Literature:

1. Value Education website, http://uhv.ac.in
2. Story of Stuff, http://www.storyofstuff.com
3. Al Gore, An Inconvenient Truth, Paramount Classics, USA
4. Charlie Chaplin, Modern Times, United Artists, USA
5. IIT Delhi, Modern Technology – the Untold Story

Course Code: HVPE102-18
Course Name: Human Values, De-addiction and Traffic Rules (Lab/ Seminar)

Program: BCA	**L**: 0 **T**: 0 **P**: 1
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 1 hour per week
Internal max. marks: 25	**Theory/Practical:** Practical
External max. marks: 0	**Duration of end semester exam (ESE):** 3hrs
Total marks: 25	**Elective status:** Ability Enhancement

One each seminar will be organized on Drug De-addiction and Traffic Rules. Eminent scholar and experts of the subject will be called for the Seminar at least once during the semester. It will be binding for all the students to attend the seminar.

Course Code: UGCA1907
Course Name: Fundamentals of Statistics

Program: BCA	**L: 3 T: 1 P: 0**
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the basic knowledge of mathematic terms.
Co requisite: NA
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.
Course Outcomes: After studying this course, students will be able to:

CO#	**Course Outcomes**
CO1	Understand the science of studying & analyzing numbers.
CO2	Identify and use various visualization tools for representing data.
CO3	Describe various statistical formulas.
CO4	Compute various statistical measures.

Detailed Contents	**Contact hours**
Unit I Statistics and Probability: Introduction to Statistics – Origin of Statistics, Features of Statistics, Scope of Statistics, Functions of Statics, Uses and importance of Statistics, Limitation of Statistics, Distrust of Statistics Collection of Data: Introduction to Collection of Data, Primary and Secondary Data, Methods of Collecting Primary Data, Methods of Secondary Data, Statistical Errors, Rounding off Data (Approximation).	8 hours

Unit II Classification of Data Frequency Distribution: Introduction Classification of Data, Objectives of Classification, Methods of Classification, Ways to Classify Numerical Data or Raw Data. Tabular, Diagrammatic and Graphic Presentation of Data: Introduction to Tabular Presentation of Data, Objectives of Tabulation, Components of a Statistical Table, General Rules for the Construction of a Table, Types of Tables, Introduction to Diagrammatic Presentation of Data, Advantage and Disadvantage of Diagrammatic Presentation, Types of Diagrams, Introduction to Graphic Presentation of Data, Advantage and Disadvantage of Graphic Presentation, Types of Graphs.	12 hours
Unit III Measures of Central tendency: Introduction to Central Tendency, Purpose and Functions of Average, Characteristics of a Good Average, Types of Averages, Meaning of Arithmetic Mean, Calculation of Arithmetic Mean, Merit and Demerits of Arithmetic Mean, Meaning of Median, Calculation of Median, Merit and Demerits of Median, Meaning of Mode, Calculation of Mode, Merit and Demerits of Mode, Harmonic Mean- Properties-Merit and Demerits.	12 hours
Unit IV Measures of Dispersion: Meaning of Dispersion, Objectives of Dispersion, Properties of a good Measure of Dispersion, Methods of Measuring Dispersion, Range Introduction, Calculation of Range , Merit and Demerits of Range, Mean Deviation, Calculation of Mean Deviation , Merit and Demerits of Mean Deviation, Standard Deviation Meaning, Calculation of Standard Deviation , Merit and Demerits of Standard Deviation, Coefficient of Variation, Calculation of Coefficient Variance, Merit and Demerits of Coefficient of Variation.	12 hours

Text Books:

1. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.
2. Statistics, Tmt. S. EzhilarasiThiru, 2005, Government of Tamilnadu.
3. Introduction to Statistics, David M. Lane.

4. Weiss, N.A., Introductory Statistics. Addison Wesley, 1999.
5. Clarke, G.M. & Cooke, D., A Basic course in Statistics. Arnold, 1998.

Reference Books:

1. Banfield J.(1999), Rweb: Web-based Statistical Analysis, Journal of Statistical Software.
2. Bhattacharya,G.K. and Johnson, R.A.(19977), Statistical Concepts and Methods, New York, John Wiley & Sons.

E-Books/ Online learning material

1. http://onlinestatbook.com/Online_Statistics_Education.pdf
2. https://textbookcorp.tn.gov.in/Books/12/Std12-Stat-EM.pdf
3. https://3lihandam69.files.wordpress.com/2015/10/introductorystatistics.pdf

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Course Code: UGCA1908
Course Name: Computer System Architecture

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Basics of Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Know about the basic functioning of various parts of computer system from hardware point of view and interfacing of various peripheral devices used with the system.
CO2	Learn number system and various types of micro-operations of processor.
CO3	Learn the communication of various components through common bus.
CO4	Learn how to design Combinational & Sequential circuits

Detailed Contents	Contact hours
Unit-I **Logic Gates:** AND, OR, NOT, NAND, NOR, XOR, XNOR, NAND & NOR as Universal Gates, Logic Gates Applications. **Boolean Algebra:** Introduction, Theorems, Simplification of Boolean Expression using Boolean Algebra, SOP & POS Forms, Realization of	12

Boolean Expression using Gates, K-Maps, Simplification of Boolean Expression using K-Maps.	
Unit-II **Combinational Logic Circuits:** Half Adder & Half Subtractor, Full Adder & Full Subtractor, Parallel Binary Adder, Binary Adder/Subtractor. **Combinational Logic Circuits:** Multiplexers & Demultiplexers, Implementation of Boolean equations using Multiplexer and Demultiplexer, Encoders & Decoders.	12
Unit-III **Sequential Logic Circuits:** Latch, Flip Flops- R-S Flip-Flop, J-K Flip-Flop, Race Around Condition, Removing Race Around Condition, Master-Slave J-K Flip-Flop, D Flip-Flop, T Flip-Flop, Applications of Flip-Flops.	8
Unit-IV **Introduction to Computer Organization:** Introduction to Computer and CPU (Computer Organization, Computer Design and Computer Architecture), Stored Program Concept- Von Neumann Architecture, Harvard Architecture, RISC and CISC Architecture. **Register Transfer and Micro operations-** Introduction to Registers, Instruction Format, Types of Instructions- Memory Reference Instructions, Register Reference Instructions and Input-Output Instructions. **Common Bus System**: Introduction to Common Bus System, Types of Buses (Data Bus, Control Bus, Address Bus), 16-bit Common Bus System--Data Movement among registers using Bus.	12

Text Books:

1. Computer System Architecture, M.M. Mano, Third Edition, PHI.
2. Digital Computer Electronics, Malvino, Second Edition, Mc-Graw Hill.
3. Modern Digital Electronics, R. P. Jain, Fourth Edition, TMH.

Reference Books:

1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Computer Organization and Architecture, J.P.Hayes, Third Edition, TMH.
3. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.
4. Digital Fundamentals, Floyd, Ninth Edition, PHI.

5. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

Course Code: UGCA1909
Course Name: Object Oriented Programming using C++

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Internal max. marks: 40	**Theory/Practical:** Theory
External max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

Detailed Contents	Contact hours
Unit-I **Principles of object oriented programming** Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language	12
Unit-II **Classes & Objects and Concept of Constructors** Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects. Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.	10

Unit-III **Inheritance and Operator overloading** Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators	12
Unit-IV **Polymorphism and File Handling** Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. Opening and Closing File, Reading and Writing a file.	10

Text Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1910
Course Name: Object Oriented Programming using C++ Laboratory

Program: BCA	**L:** 0 **T:** 0 **P:** 4
Branch: Computer Applications	**Credits:** 2
Semester: 2^{nd}	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course

Outcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

Instructions: Develop all program in C++

Assignments:

1.	Write a program to enter mark of 6 different subjects and find out the total mark (Using cin and cout statement)
2.	Write a function using reference variables as arguments to swap the values of pair of integers.
3.	Write a function to find largest of three numbers.
4.	Write a program to find the factorial of a number.
5.	Define a class to represent a bank account which includes the following members as Data members: a) Name of the depositor b) Account Number c) Withdrawal amount d) Balance amount in the account Member Functions: a) To assign initial values b)To deposit an amount c) To withdraw an amount after checking the balance d) To display name and balance.
6.	Write the above program for handling n number of account holders using array of objects.
7.	Write a C++ program to compute area of right angle triangle, equilateral triangle, isosceles triangle using function overloading concept.
8.	Consider a publishing company that markets both book and audio cassette version to its works. Create a class Publication that stores the title (a string) and price (type float) of a publication. Derive the following two classes from the above Publication class: Book which adds a page count (int) and Tape which adds a playing time in minutes(float). Each class should have get_data() function to get its data from the user at the keyboard. Write the main() function to test the Book and Tape classes by creating instances of them asking the user to fill in data with get_data() and then displaying it using put_data().
9.	Consider an example of declaring the examination result. Design three classes student, exam and result. The student has data members such as rollno, name. Create the lass exam by inheriting the student class. The exam class adds data members representing the marks scored in 5 subjects. Derive the result from exam-class and it has own data members like total, avg.
10.	Write a program for overloading of Unary ++ operator.
11.	Write a program for overloading of Binary + operator.
12.	Write a program of Virtual Functions.
13.	Write a program of Abstract Classes.

14.	Write a program to read and write from file.

Reference Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1911
Course Name: Fundamentals of Statistics Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the knowledge of Spreadsheet.
Co requisite: The students will develop analytical behavior & will have better understanding of analyzing data and testing hypotheses.
Additional material required in ESE: Minimum two exercises of each concept will be recorded in the file and the file will be submitted in End Semester Examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Represent data using various Frequency table and Graphs.
CO2	Apply various operations/ formulas using any software/package to solve statistical problems.

Instructions: Sample exercises are given below and Instructor can increase or decrease the experiments as per the requirement.

1:	Display the Maximum and Minimum market data.
2:	Display year wise strength of the students of a college in Tabular form & Graphical form.

<table>
<tr><td>3:</td><td>Calculate the average marks of the students of your College.</td></tr>
<tr><td>4:</td><td>Print measure of Central Tendency using grouped and ungrouped data.</td></tr>
<tr><td>5:</td><td>Construct & print frequency distribution using data with the following Techniques:
a) Histogram b) Frequency Polygon
c) Frequency Curve c) Ogive curves.</td></tr>
<tr><td>6:</td><td>Find out & display the Median and Mode from the following series by using suitable method:<table><tr><td>Class</td><td>156-158</td><td>158-160</td><td>160-162</td><td>162-164</td><td>164-166</td></tr><tr><td>Frequency</td><td>4</td><td>8</td><td>28</td><td>51</td><td>89</td></tr></table></td></tr>
<tr><td>7:</td><td>Calculate an appropriate measure of dispersion using grouped and ungrouped data.</td></tr>
<tr><td>8:</td><td>Make an array and calculate range of the data.</td></tr>
<tr><td>9:</td><td>Represent the placement record of the students of your college.</td></tr>
<tr><td>10:</td><td>Calculate & display Letter Grade using spreadsheet.</td></tr>
<tr><td>11:</td><td>Represent the following data by suitable graphs, determine therefrom the number of children having IQ (i) Below 105 (ii) Above 124.<table><tr><td>IQ</td><td>75-84</td><td>85-94</td><td>95-104</td><td>105-114</td><td>115-124</td><td>125-134</td></tr><tr><td>No. of Children</td><td>8</td><td>20</td><td>45</td><td>54</td><td>28</td><td>16</td></tr></table></td></tr>
</table>

Reference Books:

1. Statistics for Economics, TR Jain, VK Ohri.

2. Statistics and Data Analysis, A.Abebe, J. Daniels, J.W.Mckean, December 2000.

E-Books/ Online learning material

1. https://www.meritnation.com/cbse-class-11-commerce/economics/class_13_tr_jain.
2. http://college.cengage.com/mathematics/brase/understandable_statistics/9780618949922_ch03.pdf
3. http://www.rockcreekschools.org/pages/uploaded_files/Excel%201%20Lab%20Exercises.pdf

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Course Code: UGCA1912

Course Name: Computer System Architecture Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:** 4 hours per week
Internal max. marks: 60	**Theory/Practical:** Practical
External max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Basic knowledge of Fundamentals of Computer and IT

Co requisite: -NA-

Additional material required in ESE: -NA-

DEPUTY DIRECTOR
IKGPTU CAMPUS HOSHIARPUR

Course Outcomes:

CO#	Course outcomes
CO1	The students will be able to perform number system conversions.
CO2	The students will understand the function of all components of Computer architecture.
CO3	The students will understand various types of basic, combinational & universal logic gates
CO4	The students will learn how to design Combinational circuits like Adder, Subtractor, Decoder, Encoder, Multiplexer, Demultiplexer
CO5	The students will learn how to design Sequential circuits like Flip Flops, Counters

Assignments:

1.	To verify the Truth Table of Basic Logic Gates
2.	To verify the Truth Table of Combinational Logic Gates
3.	To verify the Truth Table of Universal Logic Gates
4.	To verify the Truth Table of Half Adder Combinational Circuit
5.	To verify the Truth Table of Full Adder Combinational Circuit
6.	To verify the Truth Table of Half Subtractor Combinational Circuit
7.	To verify the Truth Table of Full Subtractor Combinational Circuit
8.	To verify the Truth Table of Decoder Combinational Circuit
9.	To verify the Truth Table of Encoder Combinational Circuit
10.	To verify the Truth Table of Multiplexer Combinational Circuit
11.	To verify the Truth Table of De Multiplexer Combinational Circuit
12.	To verify the Truth Table of S-R Flip-Flop
13.	To verify the Truth Table of J-K Flip-Flop
14.	To verify the Truth Table of Master Slave J-K Flip-Flop
15.	To verify the Truth Table of D Flip-Flop
16.	To verify the Truth Table of T Flip-Flop
17.	To verify the working of Asynchronous Up Counter
18.	To verify the working of Asynchronous Down Counter
19.	To verify the working of Asynchronous MOD-N Counter
20.	To verify the working of Synchronous Up Counter
21.	To verify the working of Synchronous Down Counter
22.	To verify the working of Synchronous MOD-N Counter
23.	To verify the working of Asynchronous Bidirectional Counter
24.	To verify the working of Synchronous Bidirectional Counter

Reference Books:

1. Computer Organization and Architecture, Stallings, Eighth Edition, PHI.
2. Modern Digital Electronics, R. P. Jain, Fourth Edition, TMH.
3. Digital Logic & Computer Design, D. Morris Mano, Second Edition, PHI.
4. Digital and Electronic Circuits, T. C. Bartee, McGraw Hill.

5. Digital Fundamentals, Floyd, Ninth Edition, PHI.
6. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

Ability Enhancement Compulsory Course
EVS102-18 Environmental Studies

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.

2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.

3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.

4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

UNIT-1: Introduction to Environmental Studies

Multidisciplinary nature of Environmental Studies: Scope & Importance
Need for Public Awareness

UNIT-2: Ecosystems

Concept of an Ecosystem: Structure & functions of an ecosystem (Producers, Consumers & Decomposers)
Energy Flow in an ecosystem: Food Chain, Food web and Ecological Pyramids
Characteristic features, structure & functions of following Ecosystems:

- Forest Ecosystem
- Aquatic Ecosystem (Ponds, Lakes, River & Ocean)

UNIT-3: Natural Resources

Renewable & Non-renewable resources
Forest Resources: Their uses, functions & values (Biodiversity conservation, role in climate change, medicines) & threats (Overexploitation, Deforestation, Timber extraction, Agriculture Pressure), Forest Conservation Act
Water Resources: Their uses (Agriculture, Domestic & Industrial), functions & values, Overexploitation and Pollution of Ground & Surface water resources (Case study of Punjab), Water Conservation, Rainwater Harvesting,

Land Resources: Land as a resource; Land degradation, soil erosion and desertification

Energy Resources: Renewable & non-renewable energy resources, use of alternate energy resources (Solar, Wind, Biomass, Thermal), Urban problems related to Energy

UNIT-4: Biodiversity & its conservation
Types of Biodiversity: Species, Genetic & Ecosystem
India as a mega biodiversity nation, Biodiversity hot spots and biogeographic regions of India
Examples of Endangered & Endemic species of India, Red data book

UNIT-5: Environmental Pollution & Social Issues
Types, Causes, Effects & Control of Air, Water, Soil & Noise Pollution
Nuclear hazards and accidents & Health risks
Global Climate Change: Global warming, Ozone depletion, Acid rain, Melting of Glaciers & Ice caps, Rising sea levels
Environmental disasters: Earthquakes, Floods, Cyclones, Landslides

UNIT-6: Field Work
Visit to a National Park, Biosphere Reserve, Wildlife Sanctuary
Documentation & preparation of a Biodiversity (flora & fauna) register of campus/river/forest
Visit to a local polluted site: Urban/Rural/Industrial/Agricultural
Identification & Photography of resident or migratory birds, insects (butterflies)
Public hearing on environmental issues in a village

Suggested Books:

1. Bharucha, E. Text Book for Environmental Studies. University Grants Commission, New Delhi.
2. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
5. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
6. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R)
9. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford Univ. Press. 473p
10. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
11. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
12. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284 p.
13. Mckinney, M.L. & School, R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition. 639p.
14. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
15. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)

16. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
17. Rao M N. & Datta, A.K. 1987. Waste Water treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345p.
18. Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut
19. Survey of the Environment, The Hindu (M)
20. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
21. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
22. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

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Course Code: UGCA1913
Course Name: Computer Networks

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	**Course outcomes**
CO1	familiar with the different Network Models.
CO2	Understand different network technologies and their application.
CO3	update with different advanced network technologies that can be used to connect different networks
CO4	familiar with various hardware and software that can help run a smooth network

Detailed Contents	**Contact hours**
Unit-I **Data communications concepts:** Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. **Types of Networks:** LAN, MAN, WAN **Network Topologies:** Bus, Star, Ring, Mesh, Tree, Hybrid	12

Communication Channels: Wired transmissions: Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. **Communication Switching Techniques**: Circuit Switching, Message Switching, Packet Switching.	
Unit-II **Network Reference Models**: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – Frequency division, Time division, Wavelength division. **Data Link Layer Design Issues**: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)	10
Unit-III **MAC sub layer:** CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) **Network Layer:** Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.	12
Unit-IV **Transport Layer**: Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols. **Session, Presentation and Application Layers**: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer – Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.	10

Text Books:

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, "Computer Networking", Pearson Education.
4. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

Course Code: UGCA1914
Course Name: Programming in Python

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: 40%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: **-NA-**
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course Outcomes
CO1	Familiar with Python environment, data types, operators used in Python.
CO2	Compare and contrast Python with other programming languages.
CO3	Learn the use of control structures and numerous native data types with their methods.
CO4	Design user defined functions, modules, and packages and exception handling methods.
CO5	Create and handle files in Python and learn Object Oriented Programming Concepts.

Detailed Contents	Contact hours
Unit-I **Introduction to Python Programming Language:** Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.	12

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Python Data Types & Input/Output: Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command. **Operators and Expressions:** Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.	
Unit-II **Control Structures:** Decision making statements, Python loops, Python control statements. **Python Native Data Types:** Numbers, Lists, Tuples, Sets, Dictionary, Functions & Methods of Dictionary, Strings (in detail with their methods and operations).	10
Unit-III **Python Functions:** Functions, Advantages of Functions, Built-in Functions, User defined functions, Anonymous functions, Pass by value Vs. Pass by Reference, Recursion, Scope and Lifetime of Variables. **Python Modules:** Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.	12
Unit-IV **Exception Handling:** Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python. **File Management in Python:** Operations on files (opening, modes, attributes, encoding, closing), read() & write() methods, tell() & seek() methods, renaming & deleting files in Python, directories in Python. **Classes and Objects:** The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.	10

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2nd Edition, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: UGCA1915
Course Name: Data Structures

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Apply appropriate constructs of Programming language, coding standards for application development
CO2	Use appropriate data structures for problem solving and programming
CO3	Use algorithmic foundations for solving problems and programming
CO4	Apply appropriate searching and/or sorting techniques for application development.
CO5	Develop programming logic and skills.

Detailed Contents	Contact hours
Unit-I **Introduction to Data Structures:** Algorithms and Flowcharts, Basics Analysis on Algorithm, Complexity of Algorithm, Introduction and Definition of Data Structure, Classification of Data, Arrays, Various types of Data Structure, Static and Dynamic Memory Allocation, Function, Recursion. **Arrays, Pointers and Strings:** Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array	10

and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	
Unit-II **Stacks and Queue** Introduction to Stack, Definition, Stack Implementation, Operations of Stack, Applications of Stack and Multiple Stacks. Implementation of Multiple Stack Queues, Introduction to Queue, Definition, Queue Implementation, Operations of Queue, Circular Queue, De-queue and Priority Queue.	8
Unit-III **Linked Lists and Trees** Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List. **Trees** Introduction to Tree, Tree Terminology Binary Tree, Binary Search Tree, Strictly Binary Tree, Complete Binary Tree, Tree Traversal, Threaded Binary Tree, AVL Tree B Tree, B+ Tree.	14
Unit-IV **Graphs, Searching, Sorting and Hashing** **Graphs:** Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms. **Searching and Sorting:** Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort. **Hashing:** Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing	12

Text Books

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Kruse R.L. Data Structures and Program Design in C; PHI
3. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., “Data Structures and Algorithms”, AddisonWesley

Reference books

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.

Course Code: UGCA1916
Course Name: Computer Networks Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand different network technologies and their application.
CO2	Be updated with different advanced network technologies that can be used to connect different networks
CO3	Be familiar with various hardware and software that can help run a smooth network

List of assignments:

1.	Familiarization with networking components and devices: LAN Adapters, Hubs, Switches, Routers etc
2.	Familiarization with transmission media and tools: Coaxial cable, UTP cable, Crimping tool, Connectors etc
3.	Preparing straight and cross cables
4.	Study of various LAN topologies and their creation using network devices, cables and computers
5.	Configuration of TCP/IP Protocols in Windows and Linux
6.	Implementation of resource sharing (file, printer etc.)
7.	Designing and implementing class A, B and C networks
8.	Subnet planning and its implementation
9.	To configure dynamic IP address for a computer connected to a LAN
10.	Use of commands like ping, ipconfig for trouble shooting network related problems

11.	Develop a program to compute the Hamming Distance between any two code words
12.	Installation of FTP server and client
13.	To configure proxy server
14.	Familiarization with network simulation tools.

Reference Books:

1. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
2. Douglas E. Comer, "Internetworking with TCP/IP", Volume-I, Prentice Hall, India.

Course Code: UGCA1917
Course Name: Programming in Python Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems**: 90%
Internal max. marks: 60	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 40	**Elective Status :** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - Maintain practical note book as per the instructions given by the instructor.

Course Outcomes: Students will be able to :

CO#	**Course outcomes**
CO1	Solve simple to advanced problems using Python language.
CO2	Develop logic of various programming problems using numerous data types and control structures of Python.
CO3	Implement different data structures.
CO4	Implement modules and functions.
CO5	Design and implement the concept of object oriented programming structures.
CO6	Implement file handling.

List of assignments:

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.

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4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$, where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,….
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13…..n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.
12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x-x^2/2!+x^3/3!-x^4/4!+\ldots x^n/n!$ b. $x-x^3/3!+x^5/5!-x^7/7!+\ldots x^n/n!$
14.	Print all possible combinations of 4, 5, and 6.
15.	Determine prime numbers within a specific range.
16.	Count number of persons of age above 60 and below 90.
17.	Compute transpose of a matrix.
18.	Perform following operations on two matrices. 1) Addition 2) Subtraction 3) Multiplication
19.	Count occurrence of vowels.
20.	Count total number of vowels in a word.
21.	Determine whether a string is palindrome or not.
22.	Perform following operations on a list of numbers: 1) Insert an element 2) delete an element 3) sort the list 4) delete entire list
23.	Display word after Sorting in alphabetical order.
24.	Perform sequential search on a list of given numbers.
25.	Perform sequential search on ordered list of given numbers.
26.	Maintain practical note book as per their serial numbers in library using Python dictionary.
27.	Perform following operations on dictionary 1) Insert 2) delete 3) change
28.	Check whether a number is in a given range using functions.
29.	Write a Python function that accepts a string and calculates number of upper case letters and lower case letters available in that string.
30.	To find the Max of three numbers using functions.
31.	Multiply all the numbers in a list using functions.
32.	Solve the Fibonacci sequence using recursion.
33.	Get the factorial of a non-negative integer using recursion.
34.	Write a program to create a module of factorial in Python.
35.	Design a Python class named *Rectangle*, constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named *Circle* constructed by a radius and two methods which will compute the area and the perimeter of a circle.
37.	Design a Python class to reverse a string 'word by word'.

38.	Write a Python program to read an entire *text file*.
39.	Design a Python program to read first n lines of a *text file.*
40.	Construct a Python program to write and append text to a file and display the text.

Text Books:

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2^{nd}Ediiton, Dreamtech.

Reference Books:

1. Python, The complete Reference, Martin C. Brown, Mc Graw Hill Education.
2. Python in a Nutshell, A. Martelli, A. Ravenscroft, S. Holden, OREILLY.

Course Code: UGCA1918
Course Name: Data Structures Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 3^{rd}	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: - NA-

Course Outcomes: Student will be able to

CO#	Course outcomes
CO1	Apply appropriate constructs of Programming language, coding standards for application development
CO2	Develop programming skills for solving problems.
CO3	Apply appropriate searching and/or sorting techniques for application development.

Instructions: Programs may be developed in C/C++/Python/Java language.
List of assignments:

1	Program for using Dynamic Functions (malloc(), calloc(), realloc() and free()) functions.
2	Program to insert, delete and traverse an element from an array
3	Program to merge one dimensional arrays
4	Program for addition and subtraction of two matrices.
5	Program for implementing multiplication of two matrices

6	Implement linear search using one and two dimensional array.
7	Program for implementing selection sort.
8	Program for implementing insertion sort.
9	Program for implementing quick sort.
10	Program for implementing merge sort.
11	Program to calculate length of the string using user defined function.
12	Program to concatenate and compare two strings using user defined function.
13	Program for using the concept of pointer to string.
14	Program to reverse a sentence by recursion.
15	Program to delete all repeated words in string.
16	Program to find the number of vowels, consonants, digits and white space in a string.
17	Program to find the length of the longest repeating sequence in a string.
18	Program to find highest and lowest frequency character in a string.
19	Program for implementing Stack using array.
20	Program for implementing Stack using pointer.
21	Program for implementing multiple stack.
22	Program for converting infix to postfix form.
23	Program for implementing Queue using array.
24	Program for dynamic implementation of queue.
25	Program for implementing circular queue.
26	Program for implementing dequeue.
27	Program for implementing priority queue.
28	Program for implementing Singly Linked list.
29	Program for implementing Doubly Linked list.
30	Program for implementing Binary Search Tree.
31	Program for Breadth First Search (BFS) for graph traversal.
32	Program for Depth First Search (DFS) for graph traversal.

Reference Books:

1. Brijesh Bakariya. Data Structures and Algorithms Implementation through C, BPB Publications.
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., “Data Structures and Algorithms”, AddisonWesley
3. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

Course Code: UGCA1919
Course Name: PC Assembly & Troubleshooting

Program: BCA	**L**:3**T**:0 **P**:0
Branch: Computer Applications	**Credits**: 3
Semester : 3rd	**Contact hours:**33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs

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External max. marks:60	**Elective status:** Skill Enhancement
Total marks:100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	**Course outcomes**
CO1	Assemble and set up computer systems.
CO2	Configure and install computers
CO3	Install, connect and configure various peripheral devices
CO4	Diagnose and Troubleshoot issues in Computer Systems

Detailed contents	**Contact hours**
Unit I: Brief history of computer on the basis Hardware. Computer system modules/ components and its operations, need of hardware and software for computer to work, different hardware components within a computer and connected to a computer as peripheral devices, different processors used for personal computers and notebook computers.	9
Unit II: Perform installation, configuration, and upgrading of microcomputer/ computer: Hardware and software requirement, Assemble/setup microcomputer/ computer systems, accessory boards, types of motherboards, selection of right motherboard, Installation replacement of motherboard, troubleshooting problems with memory.	8
Unit III: Install/connect associated peripherals: Working of printers and scanners, Installation of printers and scanners, sharing a printer over a local area network, troubleshooting printer and scanner problems, troubleshooting hard drive problems. Drivers: Meaning, role and types.	8
Unit IV: Diagnose and troubleshooting of microcomputer/ computer systems hardware & software and other peripheral equipment: Approaches to solve a PC problem, troubleshooting a failed boot before the OS is loaded, different approaches to installing and supporting I/O device, managing faulty components. Booting and its types.	8

Text Books:

1. PC Hardware: The Complete Reference, McGraw-Hills

Reference Books:

1. The Indispensable PC Hardware Book (4th Edition) Hans-Peter Messmer
2. PC Hardware: A Beginner's Guide by Ron Gilster.

Course Code: UGCA1920
Course Name: PC Assembly & Troubleshooting Laboratory

Program: BCA	**L**:0 **T**:0 **P**:2
Branch: Computer Application	**Credits**:1
Semester: 3rd	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 95%
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:20	**Elective status:** Skill Enhancement
Total marks:50	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	Assemble and set up computer systems.
CO2	Configure and install computers
CO3	Install, connect and configure various peripheral devices
CO4	Diagnose and Troubleshoot issues in Computer Systems

List of assignments:

1.	Assembling and De Assembling of Computer System
2.	Loading and configuration procedure of Microsoft Client O/S Win XP /Win 7 and Windows 8
3.	Installation of utility tools (Software)
4.	Installation of utility tools (Drivers)
5.	Firewall configuration, Antivirus/Internet security loading and configuration procedure

6.	Installation and configuration of I/O devices – Printers, Webcams, Scanners.
7.	Installation and configuration of I/O devices – Digital Camera, USB Wi-fi, USB BT, USB Storages, Projectors
8.	Multiple OS loading and trouble shooting

Recommended Hardware:

All hardware component as mentioned above in the syllabus.

Text Books:

1. PC Hardware: The Complete Reference, McGraw-Hills

Reference Books:

1. The Indispensable PC Hardware Book (4th Edition) Hans-Peter Messmer
   PC Hardware: A Beginner's Guide by Ron Gilster

Course Code: UGCA1921
Course Name: Software Engineering

Program: BCA	**L:** 3 **T:**1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**:-
Internal max. marks: 40	**Duration of end semester exam (ESE): -**
External max. marks: 60	**Core/Elective status:** core
Total marks: 100	

Prerequisite: -
Co requisite:-
Additional material required in ESE:-
Course Outcomes: Students will be able to

CO#	**Course outcomes**
CO1	Aware about the engineering approach to analysis, design and built the software
CO2	Understand the phases and activities involved in the conventional software life cycle models
CO3	Analyse problems, and identify and define thecomputing requirements appropriate to its solution.
CO4	Apply design and development principles in the construction of software systems of varying complexity
CO5	Apply current techniques, skills, and tools necessary for computing practice.

Detailed contents	**Contact hours**
Unit 1 The Nature of Software, Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process.	10
Unit 2 Role of a system analyst, SRS, Properties of a good SRS document, functional and non-functional requirements, Decision tree and Decision table, Formal Requirements Specification, Software Cost Estimation.	10
Unit 3 Software design and its activities, Preliminary and detailed design activities, Characteristics of a good software design, Features of a design document, Cohesion and Coupling, Structured Analysis, Function Oriented Design, Object-Oriented Design.	12
Unit 4 Testing Fundamentals, Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering, Measures, Metrics, and Indicators, Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance.	12

Text Books:

1. Software Engineering–A Practitioner's Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.

Reference Books:

1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005
2. Software Engineering, Ian Sommerville, Ninth Edition, Addison-Wesley, 2011

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Course Code: UGCA1922
Course Name: Database Management Systems

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4^{th}	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Understand the basic concepts of DBMS.
CO2	Formulate, using SQL, solutions to a broad range of query and data update problems.
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4	Understand the concept of Transaction and Query processing in DBMS.

Detailed contents	Contact hours
Unit-I Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.	10
Unit-II Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.	12
Unit-III Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).	12

Unit-IV Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.	10

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).
2. “Database System Concepts”, Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).

Reference Books:

1. “SQL, PL/SQL The Programming Language of Oracle”, Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. “An Introduction to Database Systems”, C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).
3. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

Course Code: UGCA1923
Course Name: Operating Systems

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 15%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic understanding of computer system.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Discuss the evaluation of operating systems.
CO2	Explain different resource managements performed by operating system.
CO3	Describe the architecture in terms of functions performed by different types of operating systems.
CO4	Analyze the performance of different algorithms used in design of operating system components.

Detailed contents	Contact hours
Unit-I **Fundamentals of Operating system**: Introduction to Operating system, Functions of an operating system. Operating system as a resource manager. Structure of operating system (Role of kernel and Shell). Views of operating system. Evolution and types of operating systems. **Process & Thread Management**: Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization. **CPU Scheduling**: Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCSC, SJF, Round-Robin, Multilevel Queue).	12
Unit-II **Memory Management**: Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.	12
Unit-III **I/O Device Management**: I/O devices and controllers, device drivers; disk storage. **File Management**: Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.	08
Unit-IV **Advanced Operating systems:** Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication & Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization & Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure & Scheduling. Case study of Linux operating system	12

Text Books:

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

2. Principals of Operating System by Naresh Chauhan, Published by OXFORD University Press, India.

Reference Books:

1. Operating Systems by Sibsankar Haldar and Alex A. Aravind, Published by Pearson Education.
2. Operating system by Stalling, W., Sixth Edition, Published by Prentice Hall (India)

Course Code: UGCA1924

Course Name: Software Engineering Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Elicit, analyze and specify software requirements.
CO2	Analyze and translate a specification into a design
CO3	Realize design practically, using an appropriate software engineering methodology.
CO4	Plan a software engineering process life cycle.
CO5	Use modern engineering tools for specification, design, implementation, and testing

Assignments:

1.	Identify project scope and objective of given problem: *a. College automation system.* *b. Banking Management System.*
2.	Develop software requirements specification for (1 a.) and (1 b.) problem.
3.	Develop UML Use case model for a problem.
4.	Develop Class diagrams
5.	Represent project Scheduling of above-mentioned projects
6.	Use any model for estimating the effort, schedule and cost of software project
7.	Develop DFD model (level-0, level-1 DFD and Data dictionary) of the project
8.	Develop sequence diagram

9.	Develop Structured design for the DFD model developed
10.	Develop the waterfall model, prototype model and spiral model of the product
11.	Explain with reason which model is best suited for the product
12.	Develop a working protocol of any of two problem
13.	Use LOC, FP and Cyclomatic Complexity Metric of above-mentioned problem
14.	Find Maintainability Index and Reusability Index of above-mentioned problem
15.	Using any Case Tool find number of statements, depth and complexity of the prototype

Reference Books:

1. Software Engineering–A Practitioner's Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.
2. The Unified Modeling Language Reference Manual, Grady Booch, Second Edition, Addison Wesley, 2005.
3. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005.

Course Code: UGCA1925
Course Name: Database Management Systems Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 4th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100%
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Able to understand various queries and their execution
CO2	Populate and query a database using SQL DML/DDL commands.
CO3	Declare and enforce integrity constraints on a database
CO4	Programming PL/SQL including stored procedures, stored functions, cursors, packages
CO5	Able to design new database and modify existing ones for new applications and reason about the efficiency of the result

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Instructions:

1.	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2.	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3.	Use of simple select statement.
4.	Use of select query on two relations
5.	Use of nesting of queries.
6.	Use of aggregate functions.
7.	Use of substring comparison.
8.	Use of order by statement.
9.	Consider the following schema for a Library Database: BOOK (*Book_id, Title, Publisher_Name, Pub_Year*) BOOK_AUTHORS (Book_id, Author_*Name*) PUBLISHER (*Name, Address, Phone*) BOOK_COPIES (*Book_id, Branch_id, No-of_Copies*) BOOK_LENDING (*Book_id, Branch_id, Card_No, Date_Out, Due_Date*) LIBRARY_BRANCH (*Branch_id, Branch_Name, Address*) Write SQL queries to 1. Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc. 2. Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018 3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation. 4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query. 5. Create a view of all books and its number of copies that are currently available in the Library.
10.	Consider the following schema for Order Database: SALESMAN (*Salesman_id, Name, City, Commission*) CUSTOMER (*Customer_id, Cust_Name, City, Grade, Salesman_id*) ORDERS (*Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id*) Write SQL queries to 1. Count the customers with grades above Amritsar's average. 2. Find the name and numbers of all salesmen who had more than one customer. 3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.) 4. Create a view that finds the salesman who has the customer with the highest order of a day. 5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.
11.	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.

12.	Write a PL/SQL code to find sum of first 10 natural numbers using while and for loop.
13.	Write a program to create a trigger which will convert the name of a student to upper case before inserting or updating the name column of student table.
14.	Write a PL/SQL block to count the number of rows affected by an update statement using SQL%ROWCOUNT
15.	Write a PL/SQL block to increase the salary of all doctors by 1000.

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition, Ivan Bayross (2009).
2. "Oracle PL/SQL Programming", 5th Edition, Steven Feuerstein and Bill Pribyl (2009).

Course Code: UGCA1926
Course Name: Operating Systems Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After going through the practical, student will be able to:

CO#	Course outcomes
CO1	Install & configure different operating systems.
CO2	Write programs/ scripts for different scheduling algorithms.

Instructions:

1	Installation of windows OS.
2	Installation of Linux OS.
3	Dual boot installation of Operating systems.
4	Implementation of FCFS Scheduling algorithm
5	Implementation of SJF Scheduling algorithm
6	Implementation of Round-Robin Scheduling algorithm
7	Vi Editor & its commands
8	Shell Commands

9	Shell Scripting- Using variables
10	Shell Scripting- Input & Output
11	Shell Scripting- Data types
12	Shell Scripting- Use of arithmetic operators
13	Shell Scripting- if control statement programs
14	Shell Scripting- while control statement
15	Shell Scripting- for control statement

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

Course Code: UGCA1927
Course Name: Web Designing

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 3
Semester: 4th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: Student must have the basic knowledge of any text editor like notepad, notepad++ and Edit plus etc.
Co requisite: Student must know the background of Markup Language.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: The students will be able to:

CO#	Course Outcomes
CO1	Understand the core concepts of Internet and Web Services.
CO2	Describe and differentiate Programming Language and Markup Language.
CO3	List various web pages and web sites together.
CO4	Capture user input from the remote users.
CO5	Learn connectivity concepts of Front End and Back End process.

Detailed Contents	Contact hours
Unit-I **Internet Basics** Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address. **Introduction To HTML** Information Files Creation, Web Server, Web Client/Browser, Hyper Text Markup Language (HTML Tags, Paired Tags, Singular Tags), Commonly Used Html Commands (Document Head, Document Body), Title and Footer, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines). Basic Formatting Tags HTML Basic Tags, Text Formatting (Paragraph Breaks, Line Breaks), Emphasizing Material in a Web Page (Heading Styles, Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding.	8
Unit-II **Lists** Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists. **Adding Graphics To Html Documents** Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute. **Tables** Introduction (Header, Data rows, The Caption Tag), Using the Width and Border Attribute, Using the Cell padding Attribute, Using the Cell spacing Attribute, Using the BGCOLOR Attribute, Using the COLSPAN and ROWSPAN Attributes **Linking Documents** Links (External Document References, Internal Document References), Image As Hyperlinks. **Frames** Introduction to Frames: The<FRAMESET> tag, The <FRAME> tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Tag.	9
Unit-III **Forms Used by a Web Site** The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button)	8

Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element).	
Unit 4 **Introduction to JavaScript** JS Introduction, Where To, Output, Statements, Syntax, Comments, Variables, Operators, Arithmetic, Assignment, Data Types, Functions, Objects, Events, Strings, String Methods, Numbers, Number Methods, Arrays, Array Methods, Array Sort, Array Iteration, Dates, Date Formats, Date Get Methods, Date Set Methods, Math, Random, Booleans, Comparisons, Conditions, Switch, Loop For, Loop While, Break, Type Conversion, Bitwise, RegExp, Errors, Scope, Hoisting, Strict Mode, JSON, Forms, Forms API JS Functions, Function Definitions, Function Parameters, Function Invocation, Function Call, Function Apply, Function Closures	8

Text Books/Reference Books:

1. Internet for EveryOne: Alexis Leon, 1st Edition, Leon Techworld, Publication, 2009.
2. Greenlaw R; Heppe, “Fundamentals of Internet and WWW”, 2nd Edition, Tata McGraw-Hill, 2007.
3. Raj Kamal, “Internet& Web Technologies”, edition Tata McGraw-Hill Education.2009.

E-Books/ Online learning material:

1. BayrossIvan, “HTML, DHTML, JavaScript, PERL, CGI”, 3rd Edition, BPB Publication,2009.
2. Chris Payne, “Asp in 21 Days”, 2nd Edition, Sams Publishing, 2003 PDCA.
3. A Beginner's Guide To Html Http://www.Ncsa.Nine.Edit/General/Internet/www/Html.Prmter
4. https://www.tutorialspoint.com/html/html_tutorial.pdf
5. https://www.w3schools.com/js/
6. https://www.w3schools.com/html/
7. https://www.cs.uct.ac.za/mit_notes/web_programming.html
8. http://www.pagetutor.com/table_tutor/index.html

Course Code: UGCA1928
Course Name: Web Designing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits**: 1

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Semester: 4th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 80%
Internal max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement
Total marks: 50	

Prerequisite: Students must have the knowledge of editors like Notepad etc.
Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.
Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Implement Static/Dynamic concepts of web designing.
CO2	Develop ability to retrieve data from a database and present it in a web page.
CO3	Design web pages that apply various dynamic effects on the web site.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Create a simple HTML page to demonstrate the use of different tags.
2.	Design index page of a book on web designing.
3.	Display Letter Head of your college on a web page.
4.	Create a Hyperlink to move around within a single page rather than to load another page.
5.	Display letter using different Text formatting Tags.
6.	Design Time Table of your department and highlights of most important periods.
7.	Use Tables to provide layout to your web page.
8.	Embed Audio and Video into your web page.
9.	Divide a web page vertically and horizontally and display logo of your college in left pane and logo of university in right pane.
10.	Create a student Bio- Data.
11.	Design front page of hospital with different style sheets.
12.	Design a web page and display two different pages at a time.
13.	Write a program to create a login form. On submitting the form, the user should get navigated to a profile page using JavaScript.
14.	Write a code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials using JavaScript.

15.	Write an HTML code to create your Institute website/Department website/ Tutorial website for specific subject. Also use Java Script for validation.

Reference Books:

1. Greenlaw R; Hepp E, "Fundamentals of Internet and www", 2nd Edition, Tata. McGraw-Hill, 2007.
2. A Beginner's Guide to HTML
   http://www.Ncsa.Nine.Edit/General/Internet/www/
   a. html.prmter.

Online Experiment material:

1. https://www.w3schools.com/html/html_examples.asp
2. https://www.cs.uct.ac.za/mit_notes/web_programming.html

Course Code: UGCA1929
Course Name: Programming in PHP

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 3
Semester: 5th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 80%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: Students must have basic knowledge of any text editor like notepad++ and Edit plus etc.

Co requisite: Students must know the background of HTML, Front-End, Back-End & concept of Structure Query Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Learn the environment of Server Side Script.
CO2	Compare and contrast between Client Side Script & Server Side Script.
CO3	Learn the use of control structures and numerous native data types with their methods.

CO4	Make Database connectivity between Front End and Back End.
CO5	Develop Dynamic Website that can interact with different kinds of Database Languages.

Detailed contents	**Contact hours**
Unit-I **Introduction to PHP** Evolution of PHP & its comparison Interfaces to External systems, Hardware and Software requirements, PHP Scripting. Basic PHP Development, Working of PHP scripts, Basic PHP syntax, PHP data types. **Displaying type information:** Testing for a specific data type, Changing type with Set type, Operators, Variable manipulation, Dynamic variables and Variable scope.	11
Unit-II **Control Statements** if() and elseif() condition Statement, The switch statement, Using the? Operator, Using the while() Loop, The do while statement, Using the for() Loop. **Functions** Function definition, Creation, Returning values, Library Functions, User-defined functions, Dynamic function, default arguments, Passing arguments to a function by value. **String Manipulation** Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String . **Array** Anatomy of an Array, Creating index based and Associative array, Looping array using each() and foreach() loop.	10
Unit-III **Forms** Working with Forms, Super global variables, Super global array, Importing user input, Accessing user input, Combine HTML and PHP code, Using hidden fields, Redirecting the user.	10

Working with File and Directories Understanding file & directory, Opening and closing a file, Coping, renaming and deleting a file, Working with directories, File Uploading & Downloading. Generating Images with PHP: Basics computer Graphics, Creating Image.	
Unit-IV **Database Connectivity with MySql** Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).	2

Text Books:

1. PHP: The Complete Reference, "Steven Holzner" , Tata McGraw Hill.
2. Programming PHP, "Kevin Tetroi" , O' Reilly.
3. Robin Nixon, Learning PHP, MySQL, and JavaScript, Shroff/O'Reilly.

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/php/php_tutorial.pdf
2. https://www.w3schools.com/php/
3. https://education.fsu.edu/wp-content/uploads/2015/04/Learning-PHP-MySQL-JavaScript-and-CSS-2nd-Edition-1.pdf

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Course Code: UGCA1930
Course Name: Programming in PHP Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits:** 1
Semester: 5th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 80%
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement
Total marks: 50	

Prerequisite: Students must have the knowledge of editors like Notepad++ and Edit plus etc.

Co requisite: Students must know the background of Markup Language, Front-End, Back-End & concept of Structure Query Language.

Additional material required in ESE:

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

Course Outcomes: After studying this course, students will be able to:

CO#	Course outcomes
CO1	Solve simple to advanced online problems of Web Pages.
CO2	Develop logics of various programming problems using numerous data types and control structures.
CO4	Client Server concepts, Static & Dynamic environment of the websites etc.
CO5	Design and implement the concept of Database connectivity.
CO6	Front-End & Back-End concept of Database System.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

1.	Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables.
2.	Write a program to find area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute and print roots of quadratic equation.
4.	Write a program to determine whether a triangle is isosceles or not?
5.	Print multiplication table of a number input by the user.
6.	Calculate sum of natural numbers from one to n number.
7.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21…..n
8.	Write a program to find the factorial of any number.
9.	Determine prime numbers within a specific range.
10.	Write a program to compute, the Average and Grade of students marks.
11.	Compute addition, subtraction and multiplication of a matrix.
12.	Count total number of vowels in a word “Develop & Empower Individuals”.
13.	Determine whether a string is palindrome or not?
14.	Display word after Sorting in alphabetical order.
15.	Check whether a number is in a given range using functions.
16.	Write a program accepts a string and calculates number of upper case letters and lower case letters available in that string.
17.	Design a program to reverse a string word by word.
18.	Write a program to create a login form. On submitting the form, the user should navigate to profile page.
19.	Design front page of a college or department using graphics method.
20.	Write a program to upload and download files.

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Reference Books:

1. PHP: The Complete Reference, "Steven Holzner" , January 1, 2007. Tata McGraw-Hill Education.
2. Programming PHP, "Kevin Tetroi", O' Reilly.
3. Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256

E-Books/ Online learning material:

1. http://cs.petrsu.ru/~musen/php/2013/Books/Beginning%20PHP%205.3%20by%20Matt%20Doyle.pdf
2. https://www.w3schools.com/php/

Course Code: UGCA1931
Course Name: Data Warehouse and Mining

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 20%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	Justify the need of Data Warehousing & Mining
CO2	Differentiate between the Transactional and Analytical data models.
CO3	Identify the real life applications where data mining can be applied.
CO4	Apply different data mining algorithms on wide range of data sets.

Detailed Contents	Contact hours
Unit-I Need for strategic information, difference between operational and Informational data stores Data warehouse definition, characteristics, Data warehouse role and structure, OLAP Operations, Data mart, Different between data mart and data warehouse, Approaches to build a data warehouse, Building a data warehouse, Metadata & its types.	11

Unit-II Data Pre-processing: Need, Data Summarization, Methods. Denormalization, Multidimensional data model, Schemas for multi-dimensional data (Star schema, Snowflake Schema, Fact Constellation Schema, Difference between different schemas. Data warehouse architecture, OLAP servers, Indexing OLAP Data, OLAP query processing, Data cube computation	11
Unit-III Data Mining: Definition, Data Mining process, Data mining methodology, Data mining tasks, Mining various Data types & issues. Attribute-Oriented Induction, Association rule mining, Frequent itemset mining, The Apriori Algorithm, Mining multilevel association rules.	12
Unit-IV Overview of classification, Classification process, Decision tree, Decision Tree Induction, Attribute Selection Measures. Overview of classifier's accuracy, Evaluating classifier's accuracy, Techniques for accuracy estimation, Increasing the accuracy of classifier. Introduction to Clustering, Types of clusters, Clustering methods, Data visualization & various data visualization tools	10

Text Books:

1. Data Warehousing, Data Mining & Olap by Berson, Tata Mcgraw- Hill.
2. Han J., Kamber M. and Pei J., Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearson education press (1996), 1st ed.
5. Pooniah P., Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

Course Code: UGCA1937
Course Name: Data Warehouse and Mining Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 90
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Basic understanding of database concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After going through this laboratory, student will be able to:

CO#	Course outcomes
CO1	Identify different data mining tools used to analyze data.
CO2	Implement different data mining algorithms to analyze data.
CO3	Use effective visualization for representing data.

Instructions:

1	Introduction to WEKA and R tools.
2	Installation of Weka/ R Tool.
3	Introduction to various components of WEKA/ R tool.
4	Fundamental programming using WEKA/ R tool.
5	Implementing data preprocessing.
6	Implementing apriori algorithm.
7	Implementing classification using decision tree.
8	Implementing classification using decision tree induction.
9	Implementation k-mean clustering
10	Implementing different Data visualization tools.

- Number of practical's can be more than 10 by implementing these algorithms on different data sets. Also, visualization tools can be used simultaneously to represent the outcomes in a better way

Reference Books:

1. Data Mining: Practical Machine Learning Tools and Techniques, 3rd edition by Ian H. Witten, Eibe Frank, Mark A. Hall Published by Morgan Kaufmann.
2. Data analytics using R, 1st edition by Seema Acharya Published by Tata Mcgraw Hill.

E Books/ Online learning material

Students can refer to youtube channel: Data Mining with Weka (WekaMOOC) by University of WAIKATO for reference using the following link:
https://www.youtube.com/user/WekaMOOC

Course Code: UGCA1932
Course Name: Programming in Java

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Semester: 5th	**Contact hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 40%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks:100	

Prerequisite: Basic knowledge of programming like Programming in C.
Co requisite: - Knowledge of Object Oriented Concepts through any language like C++.
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Familiarize with the concept of Object Oriented concepts by implementing Java Programming.
CO2	Learn the concepts of classes & objects with the features of reusability and implementation of the same with various control structures to solve real world problems.
CO3	Understand and design built-in and user defined functions/methods, interfaces and packages etc.
CO4	Handle various types of data using arrays & strings and handling of exceptions occurred in programs.
CO5	Utilize multithreading and applet features of Java for efficient and effective programming.
CO6	Create and handle files in Java.

Detailed Contents	Contact hours
Unit-I **Java Programming Fundamentals:** Introduction to Java, Stage for Java, Origin, Challenges of Java, Java Features, Java Program Development, Object Oriented Programming. **Java Essentials:** Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables & Blocks, Types of Comment in Java.	10
Unit-II **Control Statements:** Decision making statements (if, if-else, nested if, else if ladder, switch, conditional operator), Looping statements (while, do-while, for, nested loops), Jumping statements (Break and Continue).	12

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Classes and Objects: Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection. **Inheritance:** Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class.	
Unit-III **Arrays and Strings:** Introduction to array, Processing Array Contents, Passing array as argument, Returning array from methods, Array of objects, 2D arrays, Array with three or more dimensions. String class, string concatenation, Comparing strings, Substring, Difference between String and String Buffer class, String Tokenizer class. **Interface and Packages:** Basics of interface, Multiple Interfaces, Multiple Inheritance Using Interface, Multilevel Interface, Packages, Create and Access Packages, Static Import and Package Class, Access Specifiers. **Exception Handling:** Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions.	10
Unit-IV **Multithreading:** Introduction, Threads in Java, Thread Creation, Lifecycle of Thread, Joining a Thread, Thread Scheduler, Thread Priority, Thread Synchronization. **Applets:** Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event-Handling. **File and I/O Streams:** File Class, Streams, Byte Streams, Filtered Byte Streams, Random Access File Class, Character Streams.	12

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, TMH.

Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.

Course Code: UGCA1938
Course Name: Programming in Java Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 5th	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 90%
Internal max. marks: 60	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 40	**Elective status:** Core
Total marks: 100	

Prerequisite: - Basic knowledge of Programming language like Programming in C.
Co requisite: - Knowledge of Object Oriented Concepts through any language like C++.
Additional material required in ESE: - Minor Project.

Course Outcomes: Students will be able to

CO#	**Course Outcomes**
CO1	Implement Core Java concepts.
CO2	Solve computational problems using various operators of Java.
CO3	Design solutions to complex by handling exceptions that may occur in the programs.
CO4	Solve complex and large problems using the concept of multithreading.
CO5	Implement interfaces and design packages.

Instructions: All programs are to be developed in Java programming language.
List of assignments:

1.	Write a program to perform following operations on two numbers input by the user: 1) Addition 2) subtraction 3) multiplication 4) division
2.	Write a Java program to print result of the following operations. 1. -15 +58 * 45 2. (35+8) % 6 3. 24 + -5*3 / 7 4. 15 + 18 / 3 * 2 - 9 % 3
3.	Write a Java program to compute area of: 1) Circle2) rectangle 3) triangle 4) square
4.	Write a program to convert temperature from Fahrenheit to Celsius degree using Java.
5.	Write a program through Java that reads a number in inches, converts it to meters.
6.	Write a program to convert minutes into a number of years and days.
7.	Write a Java program that prints current time in GMT.
8.	Design a program in Java to solve quadratic equations using if, if else
9.	Write a Java program to determine greatest number of three numbers.
10.	Write program that gets a number from the user and generates an integer between 1 and 7 subsequently should display the name of the weekday as per that number.

11.	Construct a Java program to find the number of days in a month.
12.	Write a program to sum values of an Single Dimensional array.
13.	Design & execute a program in Java to sort a numeric array and a string array.
14.	Calculate the average value of array elements through Java Program.
15.	Write a Java program to test if an array contains a specific value.
16.	Find the index of an array element by writing a program in Java.
17.	Write a Java program to remove a specific element from an array.
18.	Design a program to copy an array by iterating the array.
19.	Write a Java program to insert an element (on a specific position) into Multidimensional array.
20.	Write a program to perform following operations on strings: 1) Compare two strings. 2) Count string length. 3) Convert upper case to lower case & vice versa. 4) Concatenate two strings. 5) Print a substring.
21.	Developed Program & design a method to find the smallest number among three numbers.
22.	Compute the average of three numbers through a Java Program.
23.	Write a Program & design a method to count all vowels in a string.
24.	Write a Java method to count all words in a string.
25.	Write a method in Java program to count all words in a string.
26.	Write a Java program to handle following exceptions: 1) Divide by Zero Exception. 2) Array Index Out Of B bound Exception.
27.	To represent the concept of *Multithreading* write a Java program.
28.	To represent the concept of all types of inheritance supported by Java, design a program.
29.	Write a program to implement *Multiple Inheritance* using interface.
30.	Construct a program to design a package in Java.
31.	To write and read a plain text file, write a Java program.
32.	Write a Java program to append text to an existing file.
33.	Design a program in Java to get a list of all file/directory names from the given.
34.	Develop a Java program to check if a file or directory specified by pathname exists or not.
35.	Write a Java program to check if a file or directory has read and write permission.

Text Books:

1. Programming with Java A Primer, 5th Edition, E. Balagurusamy, TMH.
2. Java Programming for Core and Advanced Learners, Sagayaraja, Denis, Karthik, Gajalakshmi, Universities Press.
3. Java Fundamentals, A Comprehensive Introduction, H. Schildt, D. Skrien, TMH.

Reference Books:

1. Java, The complete Reference, H. Schildt, 7th Edition, TMH.
2. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1933
Course Name: Internet of Things

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To introduce the terminology, technology and applications of IoT
CO2	To use the concept of M2M (machine to machine) with necessary protocols
CO3	To implement data and knowledge management and use of devices in IoT Technology
CO4	To introduce the Raspberry PI platform, that is widely used in IoT applications

Detailed Contents	Contact hours
Unit-I Definition and Need of IoT, Characteristics of IoT, Physical Design of IoT – IoT Protocols, Logical Design of IoT, IoT Enabled Technologies – Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels and Templates.	11
Unit-II Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle. M2M Applications, Software Defined Networks, Network Function Virtualization.	11

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Unit-III Need for IoT System Management, Simple Network Management Protocol, Network Operator Requirements, NETCONF, YANG, IoT System Management with NETCOZF-YANG, IoT Design Methodology.	11
Unit-IV Introduction to Raspberry PI-Interfaces (serial, SPI, I2C), Introduction to Cloud Storage Models and Communication APIs Webserver – Web Server for IoT, Cloud for IoT, Security Management in an IoT System.	11

Text Books:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, First Edition, 2015, University Press.

Reference Books:

1. The Internet of Things-Enabling Technologies, Platforms, and Use Cases, Pethuru Raj & Anupama C. Raman, CRC Press, 2017.
2. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014
3. The Definitive Guide to the Internet of Things for Business, Syed Zaeem Hosain, Aeris Communications, 2016, 2nd edition.
4. Internet of Things: Architecture and Design Principals, Raj Kamal, McGraw-Hill, 2017.

Course Code: UGCA1939
Course Name: Internet of Things Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5^{th}	**Contact hours:** 4 hours a week
Theory/Practical: Practical	**Percentage of numerical/design problems:** --
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

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Course Outcomes:

CO#	Course outcomes
CO1	Understand the concepts of Internet of Things
CO2	Understand and analyzing sensor generated data
CO3	To Implement Data and Knowledge Management and use of Devices in IoT Technology.
CO4	Build small IoT applications

Instructions:

1	Interfacing Light Emitting Diode (LED) for Blinking LED
2	Interfacing Button and LED for LED blinking when button is pressed
3	Interfacing Light Dependent Resistor (LDR) and LED for displaying automatic night lamp
4	Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)
5	Interfacing Liquid Crystal Display (LCD) to display data generated by sensor on LCD
6	Interfacing Air Quality Sensor-pollution (e.g. MQ135) to display data on LCD , switch on LED when data sensed is higher than specified value.
7	Interfacing Bluetooth module (e.g. HC05) for receiving data from mobile phone on Arduino and display on LCD
8	Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

Reference Books:

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madisetti, First Edition, 2015, Universities Press.
2. Arduino Projects for Engineers, Neerparaj Rai, First Edition, 2016, BPB Publications.
3. 21 Internet of Things (IOT) Experiments, Yashavant Kanetkar, Shrirang Korde, First Edition, 2015, BPB Publications.

List of components:

1. One kit for 3-4 students: Arduino Uno, sensors (Bluetooth module (HC05), MQ135, DHT11, breadboard, LCD, 2-relay module etc.)
2. Consumables: LED, button, connecting wires, LDR, LM35, battery, etc

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Course Code: UGCA1934
Course Name: Computer Graphics

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours

Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Let students understand basics of Computer Graphics, Input/output primitive and basic transformations, which can be applied on objects of graphics.
CO2	To develop the logical and reasoning skills of the students.
CO3	Learn graphical primitives and their algorithms

Detailed contents	Contact hours
Unit-I **Introduction to Computer Graphics** Applications of Computer Graphics. Graphs and Types of Graphs **Input Devices:** Light Pens, Graphic Tablets, Joysticks, Track Ball, Data Glove, Digitizers, Image Scanner. **Video Display Devices:** Refresh Cathode Ray Tube, Raster Scan displays, Random Scan displays, Color CRT - monitors and Color generating techniques (Shadow Mask, Beam Penetration), Flat-Panel Displays; 3-D Viewing Devices, Graphics monitors and workstations, Color Models (RGB and CMY), Lookup Table. **Introduction Virtual Reality & Environments:** Applications in Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.	11
Unit-II **Scan-conversions** Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse using direct method, Bresenham's algorithms for line & circle and Midpoint Ellipse Algorithm along with their derivations, Area Filling Techniques, Flood Fill Techniques, Character Generation.	11
Unit-III	10

2 – Dimensional Graphics Cartesian and need of Homogeneous co-ordinate system, Geometric transformations (Translation, Scaling, Rotation, Reflection, Shearing), Viewing transformation and clipping (line, polygon and text) using Cohen-Sutherland, Sutherland Hodgeman and Liang Barsky algorithm for clipping.	
Unit-IV **3 – Dimensional Graphics** Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, Rotation), Mathematics of Projections (Parallel & Perspective). Color Shading. Introduction to Morphing techniques.	12

Text Books:

1. D. Hearn and M.P. Baker, *Computer Graphics*, PHI New Delhi.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes,. R.L Phillips, *Computer Graphics Principles & Practices*, Second Edition, Pearson Education, 2007.
3. R.A. Plastock and G. Kalley, *Computer Graphic*, McGraw Hill, 1986.

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in

Course Code: UGCA1940
Course Name: Computer Graphics Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To equip students with techniques for developing structured computer program.
CO2	Understand basics of computer graphics
CO3	To develop the logical and reasoning skills of the students

CO4	Practical applications of graphics, Program development and basic animations without using graphical software.

Instructions:

1.	Use of basic functions of graphic available like circle, putpixel, rectangle, arc, ellipse, floodfill, setcolor etc.
2.	Design a logo/poster using primitive functions.
3.	Draw a 3 D object using palettes.
4.	Line Drawing Algorithm : Direct method and DDA
5.	Bresenham's Line Drawing Algorithm
6.	Circle Generating Algorithm : Equation and trigonometric function.
7.	Bresenham's Circle Generating Algorithm
8.	Draw an ellipse using Midpoint Algorithm.
9.	Translation transformation on a polygon.
10.	Scaling transformation on a polygon.
11.	Rotation transformation on a polygon.
12.	Reflection transformation on a polygon.
13.	Shearing transformation on a polygon.
14.	Mixed transformation on an object
15.	Minor project (eg Game/ Animation etc.)

Reference Books:

1. D. Hearn and M.P. Baker, *Computer Graphics,* PHI New Delhi.
2. J.D. Foley, A.V. Dam, S.K. Feiner, J.F. Hughes,. R.L Phillips, *Computer Graphics Principles & Practices*, Second Edition, Pearson Education, 2007.
3. R.A. Plastock and G. Kalley, *Computer Graphic*, McGraw Hill, 1986.
4. Mark Lutz, *Learning Python*, O'REILY

Course Code: UGCA1935
Course Name: Linux Operating System

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 5th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 60%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: Operating System
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After completing this course, students will be able to:

CO#	Course outcomes
CO1	Discuss the evolution of Open Source operating systems.
CO2	Operate open source operating system like Linux.
CO3	Create scripts in Linux.
CO4	Implement advanced concepts using open source operating system.

Detailed contents	Contact hours
Unit-I **Introduction to Linux** History of Linux & Unix, Overview of Linux Operating System, structure of Linux Operating system, Installation. Desktops (The X window System, GNOME, KDE), desktop operations. Different types of editors, vi editor and its command.	12
Unit-II **Shells and Utilities** Role of shells in the Linux environment, Different types of shells in Linux Operating system, Shell configuration: Shell initialization & configuration directories & file, Aliases, Filename expansion, Standard Input/ Output & Redirection, Pipes, Managing Jobs. **Shell Scripting:** Different types of statements in shell script, variables in shell, assign values to shell variables, Default shell variables value, Rules for Naming variables, Display the value of shell variables Getting User writing simple shell scripts to accept input from the user and display a message on screen, Shell scripts to implement various control statements.	12
Unit-III **Files Systems & Linux Software** Linux Files, File structure, commands for managing files & directories with other commonly used commands, Software Management, Office and Database Applications, Graphics Tools and Multimedia, Internet & Network services, Web, FTP & java Clients.	10
Unit-IV **Linux Administration** Managing users, Superuser Control, System Run levels, Managing File Systems,	10

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Kernel Administration: Linux kernel sources, rebuilding kernel, installing kernel, Virtualization, backup management.	

Text Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Linux in a Nutshell: A Desktop Quick Reference, 6th Edition by Stephen Figgins, Arnold Robbins, Ellen Siever & Robert Love Published by O'Reilly Media.
3. Linux Administration: A Beginner's Guide by Steve Shah & Wale Soyinka, Published by McGraw-Hill Education
4. Unix Shell Programming by Yashavant P. Kanetkar, Published by BPB Publishers.

Course Code: UGCA1941
Course Name: Linux Operating System Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 5^{th}	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:** 100
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Operating system
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Installation & administration of Linux operating system
CO2	Implementing various services on Linux operating system.

Instructions:

1	Installation of Linux OS.
2	Writing advanced shell programs
3	Installation and management of printers
4	Using gcc compiler to write c programs
5	Configuring mail server
6	Configuring FTP server
7	Connecting to internet
8	Implementing different commands to manage file system

9	Implementation of virtualization
10	Becoming super user and implementing configuration commands
11	Implementing commands to manage users

- Instructor can select the commands, utilities and services to be managed on their own.

Reference Books:

1. Linux: The complete reference by Richard Petersen, Published by Tata McGraw-Hill Publication.
2. Linux in a Nutshell: A Desktop Quick Reference, 6th Edition by Stephen Figgins, Arnold Robbins, Ellen Siever & Robert Love Published by O'Reilly Media.
3. Unix Shell Programming by Yashavant P. Kanetkar, Published by BPB Publishers.

Course Code: UGCA1936
Course Name: Cloud Computing

Program: BCA	**L**: 3 **T**: 1 **P**: 2
Branch: Computer Applications	**Credits:** 4
Semester: 5^{th}	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Ability to understand the basic concept and importance of cloud computing.
CO2	Access the suitability of migrating to a cloud solution for different applications.
CO3	Compare and evaluate the virtualization technologies.
CO4	Ability to monitor and manage the cloud resources, applications and data while addressing the security concerns.
CO5	Use cloud solutions offered by industry leaders for various applications.

Detailed contents	Contact hours
Unit-I **Overview of Computing Paradigm:** Recent trends in Computing -Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing. **Introduction to Cloud Computing:** Vision of Cloud Computing, Defining a Cloud, Cloud delivery Model, Deployment Model, Characteristics, Benefits of Cloud Computing, Challenges ahead. Cloud computing vs. Cluster computing vs. Grid computing. **Migrating into a Cloud:** Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud.	12
Unit-II **Virtualization:** Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Hypervisor Technology Examples- Xen, VMware, Microsoft Hyper-V. **Capacity Planning:** Elasticity vs Scalability, Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	12
Unit-III **SLA Management in Cloud Computing:** Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management. **Securing Cloud services:** Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. Steps to ensure security over cloud.	10
Unit-IV **Cloud Platforms in Industry:** Amazon Web Services-Compute Services, Storage Services, Communication Services, Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life Cycle. Cost Model. Microsoft Azure-Azure Core Concepts, SQL Azure, Windows Azure Platform Appliance.	10

Text Books:

1. 1.Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and Thamarai Selvi, Tata McGraw Hill, ISBN-13: 978-1-25-902995-0, New Delhi, India, Feb 2013.
2. Cloud Computing Bible, Barrie Sosinsky, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-2980-3, New Delhi, India, 2011.
3. Cloud Computing: Principles and paradigms, Raj Kumar Buyya, James Broberg, Andrezei M. Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6, New Delhi, India, 2011

Reference Books:

1. 1.Cloud Computing for Dummies, Fern Halper, Hurwitz, Robin Bloor, Marcia Kaufman, Wiley India Pvt. Ltd, ISBN-13: 978-0-47-0597422, New Delhi, India, 2011.
2. Dr. Saurabh Kumar, Cloud Computing: Insights into New-Era Infrastructure, Wiley India Pvt. Ltd, ISBN-13: 978-8-12-6528837, New Delhi, India, 2011.

E Books/ Online learning material

1. P.D. Kaur, I. Chana, Unfolding the distributed computing paradigm, in: Proceedings of the IEEE International Conference on Advances in Computer Engineering, ACE, Bangalore, Karnataka, India, 2010, pp. 339–342.
2. P. Mell and T. Grance, “The NIST definition of cloud computing (draft), NIST Spec. Publ. 800 (2011) 7.

Course Code: UGCA1942
Course Name: Cloud Computing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 5th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Learn the use of cloud computing tools offered by industry leaders.
CO2	Develop and deploy cloud applications using popular cloud platforms.
CO3	Configuration of the virtual machines on the cloud and building of a private cloud.

Instructions:

1.	Enlist various companies in cloud business and the corresponding services provided by them and tag them under SaaS , PaaS & IaaS.
2.	Create a warehouse application using tools supplied by any SaaS provider.
3.	Implementation of Para-Virtualization using VM Ware‘s Workstation/ Oracle‘s Virtual Box and Guest O.S. Learn creation, migration, cloning and managing of virtual machines.
4.	Using public cloud service providers tools for exploring the usage of IaaS, PaaS and SaaS cloud services.
5.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Course Code: UGCA1943
Course Name: Android Programming

Program: BCA	**L**: 3 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 3
Semester: 6th	**Contact hours:** 33 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Skill Enhancement
Total marks: 100	

Prerequisite: The course will help students to develop applications for Android Mobile Phone. The students will use a software emulator for the phone to develop the application and a real phone to demonstrate the application. The main emphasis is on the aspects like develop, debug and test a variation of an existing application. Students must know all the basic concepts of Java.

Co requisite: -NA-

Additional material required in ESE: Students can carry their own data cable to execute the application built on Simulator for the sake of fast speed.

Course Outcomes:

CO#	Course outcomes
CO1	Students will be able to do work on Android OS.
CO2	Students will be able to create different type of Android based applications.
CO3	Students will be able to discuss various security issues in Android platform.
CO4	Students will be able to implement various database applications and content providers.
CO5	Students will be able to differentiate among various types of operating systems.

Detailed contents	Contact hours
Unit-I Characteristics of Mobile applications, Introduction to Android Development Environment, Advantages and Futures of Android, Architecture and working of Android, User-interface design for mobile applications and managing application data.	8
Unit-II Integrating cloud services, networking, OS and hardware into mobile-applications. Enterprise requirements in mobile applications: Performance, Scalability, Modifiability, Availability and Security.	7
Unit-III Mobile Software Engineering (Design Principles, Development, Testing methodologies for mobile applications.	7
Unit-IV Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.	8

Text Books:

1. Android Studio Application Development, Belen Cruz, Zapata, Packt Publishing
2. Deitel, P., Deitel, H., Deitle, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall

Reference Books:

1. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.
2. Professional Android 4 Application Development, Reto Meier, Wrox Publication
3. Beginning iPhone Development with Swift, David Mark, A press Publication

E Books/ Online learning material

1. d.android.com
2. Safari Textbooks Online: http://library.ohio-state.edu/search/y?SEARCH=Safari
3. https://www.androidauthority.com/best-ebook-ereader-apps-for-android-170696/

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1944
Course Name: Android Programming Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 2 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems:--**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 20	**Elective status:** Skill Enhancement Laboratory
Total marks: 50	

Prerequisite: The course will help students to develop applications for Android Mobile Phone. The students will use a software emulator for the phone to develop the application and a real phone to demonstrate the application. The main emphasis is on the aspects like develop, debug and test a variation of an existing application. Students must know all the basic concepts of Java.

Co requisite: -NA-

Additional material required in ESE: Students can carry their own data cable to execute the application built on Simulator for the sake of fast speed.

Course Outcomes:

CO#	Course outcomes
CO1	Students will be able to do work on Android OS.
CO2	Students will be able to create different type of Android based applications.
CO3	Students will be able to discuss various security issues in Android platform.
CO4	Students will be able to implement various database applications and content providers.
CO5	Students will be able to design User Interface and develop activity for android app.

Instructions:

1.	Installation of Java, android Framework
2.	Android SDK Manager and its all components
3.	Programs based on the overriding, constructor, classes in Java
4.	Programs based on the Final, this and static keyword in Java
5.	Directory Structure of an Android Project, Common Default Resources Folders, The Values Folder, Leveraging Android XML.
6.	Applications based on Text Boxes and Button
7.	Applications based on Check Boxes and button
8.	Applications based on Radio Buttons
9.	Applications based on Intents and Intent Filters
10.	Applications based on Activities and services
11.	Applications based on Action Bar
12.	Applications based on Option Menu
13.	Applications based on Rating Bar
14.	Applications based on Media Player
15.	Applications based on Content Providers
16.	Applications based on accessing camera

17.	Applications based on accessing location
18.	Applications based on the activation of sensors
19.	Applications based on Animations

Reference Books:

1. Deitel, P., Deitel, H., Deitle, A., and Morgano, M., Android for Programmers – An App-Driven Approach, Prentice Hall, Upper Saddle River, NY, 2012, ISBN: 212136-0.
2. Professional Mobile Application Development, JEFFMCWHERTER, SCOTTGOWELL, Wiley.

Course Code: UGCA1945
Course Name: Artificial Intelligence

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks:100	

Prerequisite: NA--
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand the significance and domains of Artificial Intelligence and knowledge representation.
CO2	Examine the useful search techniques; learn their advantages, disadvantages and comparison.
CO3	Understand important concepts like Expert Systems, AI applications.
CO4	Be exposed to the role of AI in different areas like NLP, Pattern Recognition etc.
CO5	Learn the practical applicability of intelligent systems, specifically its applications.

Detailed Contents	Contact hours
Unit-I	10

Introduction-What is intelligence? Foundations of artificial intelligence (AI). History of AI. AI problems: Toy Problems, Real World problems- Tic-Tac-Toe, Water Jug, Question-Answering, 8-puzzle, 8-Queens problem. Formulating problems, Searching for Solutions. **Knowledge Representation:** Propositional Logic, Propositional Theorem Proving-Inference and Proofs, Proof by Resolution, Horn Clauses and definite Clauses, Forward and Backward chaining; First order Logic, Inference in First Order Logic.	
Unit-II **Uncertain Knowledge and Reasoning:** Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic. **Structured Knowledge:** Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.	**10**
Unit-III **Uninformed Search strategies-** Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed search strategies. **Informed (Heuristic) Search Strategies-** Hill Climbing, Simulated Annealing, Genetic Algorithm, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search.	**12**
Unit-IV **Natural language processing:** Grammars, Parsing. **Pattern Recognition:** Recognition and Classification Process-Decision Theoretic Classification, Syntactic Classification; Learning Classification Patterns, Recognizing and Understanding Speech. **Expert System Architectures:** Characteristics, Rule-Based System Architectures, Nonproduction System Architectures, Knowledge Acquisition and Validation.	12

Text Books:

1. Artificial Intelligence-A Modern Approach, Russel and Norvig, Prentice Hall.
2. Artificial Intelligence, Elaine Rich, Kevin Knight and SB Nair, 3 Ed.,Tata McGraw-Hill.
3. Artificial Intelligence And Expert Systems, D.W.Patterson, Prentice Hall.

4. Artificial Inteligence Structures and Strategies for complex Problem Solving, George F. Luger, Pearson Addison Wesley.

Reference Books:

1. Artificial Intelligence-A New Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.

Course Code: UGCA1951
Course Name: Artificial Intelligence Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 weeks per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: Working Knowledge of Python Programming Language
Co requisite: Installing Python, Installing packages, Loading data
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Developing simple applications using AI tools.
CO2	Attain the capability to represent various real life problem domains using logic based techniques and use this to perform inference or planning.
CO3	Formulate and solve problems with uncertain information using Bayesian approaches.
CO4	Apply concept Natural Language processing to problems leading to understanding of cognitive computing.

Instructions:

1.	Learn the building blocks of Logic Programming in Python.
2.	Python script for comparing mathematical expressions and finding out unknown values.
3.	Use logic programming in Python to check for prime numbers.
4.	Use logic programming in Python parse a family tree and infer the relationships between the family members.
5.	Python script for building a puzzle solver.
6.	Implementation of Naïve Bayes classifier, computing its accuracy and visualizing its performance.
7.	Creation of a fuzzy control system which models how you might choose to tip at a restaurant.

8.	Implementation of uninformed search techniques in Python.
9.	Implementation of heuristic search techniques in Python.
10.	Python script for tokenizing text data.
11.	Extracting the frequency of terms using a Bag of Words model.
12.	Predict the category to which a given piece of text belongs.
13.	Python code for visualizing audio speech signal
14.	Python code for Generating audio signals
15.	Python code for Synthesizing tones to generate music

Reference Books:

1. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.

Course Code: UGCA1946
Course Name: R Programming

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact Hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: 40%
Internal max. marks: 40	**Duration of end semester exam (ESE)**: 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks:100	

Prerequisite: Logics of basic programming terminologies.
Co requisite: Simulation study.
Additional material required in ESE: **-NA-**

Course Outcomes:

CO#	Course Outcomes
CO1	Familiarization with the concept of R programming and its application in Data Science.
CO2	Understand and learn the difference between vectors and arrays and their implementation to solve real world problems.
CO3	Utilize the concept of data frames, lists, factors, tables and R structures and to implement the same.
CO4	Able to solve problems using Object Oriented features of R programming and handling different sorts of data using strings.
CO5	Applying simulation and produce the results in graphical form for better understanding of output/results.

Detailed Contents	Contact hours
Unit-I	11

R Programming Fundamentals: Introduction to R, Installing R, Windows/Linux/Mac Installation, Setting up Path, Using Packages, and Running R: Interactive Mode, Batch Mode, Getting Help, Startup and Shut Down. **Vectors:** Scalars, Vectors, Arrays and Matrices, Declarations, Recycling, Common Vector Operations, Using all() and any(), Na and Null Values, Filtering, ifelse() Function. **Matrices and Arrays:** Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding & Deleting Matrix Rows and Columns, Difference Between Matrix and Vector.	
Unit-II **Lists:** Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists. **Data Frames:** Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames. **Factors and Tables:** Introduction, Common Functions use with Factors, Working with Tables. **R Programming Structures:** Control Statements, Arithmetic and Boolean Operators, Default Values for Arguments, Return Values, Recursion.	11
Unit-III **Object Oriented Programming:** Concept of Classes, S3 Classes, S4 Classes, S3 Versus S4 Classes, Managing Objects. **Input/Output:** Accessing Keyboard and Monitor, Reading and Writing Files, Accessing the Internet. **String Manipulation:** Overview of String Manipulation Functions [grep(), nchar(), paste(), sprintf(), substr(), strsplit(), regexpr(), gregexpr(), Regular expression].	12
Unit-IV **Graphics:** Creating Graphs, Customizing Graphs, Saving Graphs to Files, Creating 3D Plots. **Debugging:** Principles of Debugging, Use of Debugging Tool, ~~Using~~ R Programming Debugging Facilities. **Simulation:** Generating Random Numbers, Setting the Random Number Seed, Simulating ~~a~~ Linear Model, Random Sampling.	10

Text Books:

1. The ART of R Programming, Norman Matloff, No Starch Press.
2. R Programming for Data Science, Roger D. Peng, Lean Publishing.
3. R Programming for Beginners, S. Rakshit, TMH.

Reference Books:

1. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1952
Course Name: R Programming Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**:4
Branch: Computer Applications	**Credits**: 2
Semester: 6^{th}	**Contact hours**: 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems**: --
Internal max. marks: 60	**Duration of End Semester Exam (ESE)**: 3hrs
External max. marks: 40	**Elective Status:** Elective
Total marks: 100	

Prerequisite: - Logics of basic programming terminologies.
Co requisite: - Simulation study.
Additional material required in ESE: - Record the *Simulation Results* on practical file.

Course Outcomes: Students will be able to

CO#	Course Outcomes
CO1	Solve basic to advanced problems using R programming.
CO2	Implement arrays and matrices.
CO3	Solve problems with data frames and lists.
CO4	Design and implement vectors and distinguish arrays from vectors.
CO5	Implement factors.

Instructions: All programs are to be developed in R Programming Language.

1.	Design a program to take input from the user (name and age) and display the values through R Programming.
2.	Write a program to get the details of the objects in memory using R Programming.
3.	Create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91 using R Programming.
4.	Create a vector which contains 10 random integer values between -50 and +50 using R Programming.
5.	Demonstrate through a program to display the details of the objects in memory.
6.	Write a R program to get the first 10 Fibonacci numbers.
7.	Show all prime numbers up to a given number usingh R rogramming..

8.	Design a R program to find the factors of a given number.
9.	Write a R program to find the maximum and the minimum value of a given vector.
10.	Write a program to get the unique elements of a given string and unique numbers of vector.
11.	Convert a given matrix to a 1 dimensional array through R programming.
12.	Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors.
13.	Create a 3 dimensional array of 24 elements using dim() function.
14.	Write a R program to create an array using four given columns, three given rows and two given tables, also display the contents of the array.
15.	To convert a given matrix to 1 dimensional array design a R program.
16.	Write a R program to concatenate two given factor in a single factor.
17.	Write a R program to create an 3 dimensional array of 24 elements using the dim() function.
18.	Construct a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
19.	Write a R program to create a data frame from four given vectors.
20.	Write a program to get the structure of a given data frame.
21.	Design a R program to get the statistical summary and nature of the data of a given data frame.
22.	Write a R program to extract specific column from a data frame using column name.
23.	Design a R program to create a data frame from four given vectors.
24.	Demonstrate a R program to get the structure of a given data frame.
25.	Write a R program to get the statistical summary and nature of the data of a given data frame.
26.	Design a R program to extract specific column from a data frame using column name.
27.	Demonstrate a R program to create a data frame from four given vectors.
28.	Write a R program to create a matrix taking a given vector of numbers as input. Display the matrix.
29.	Construct a R program to create a matrix taking a given vector of numbers as input and define the column and row names. Display the matrix.
30.	Write a R program to access the element at 3^{rd} column and 2^{nd} row, only the 3^{rd} row and only the 4^{th} column of a given matrix.
31.	Develop a R program to create a vector of a specified type and length. Create vector of numeric, complex, logical and character types of length 6.
32.	Write a R program to add two vectors of integers type and length.
33.	Design a R program to append value to a given empty vector
34.	Write a R program to multiply two vectors of integers type and length.
35.	Design a R program to create a list containing strings, numbers, vectors and a logical values.
36.	Write a R program to list containing a vector, a matrix and a list and give names to the elements in the list.
37.	Demonstrate a R program to find the levels of factor of a given vector.

38.	Write a R program to change the first level of a factor with another level of a given factor.
39.	Design a R program to create an ordered factor from data consisting of the names of months.
40.	Construct graphical output & display the results of any five tasks using simulator.

Text Books:

1. The ART of R Programming, Norman Matloff, No Starch Press.
2. R Programming for Data Science, Roger D. Peng, Lean Publishing.
3. R Programming for Beginners, S. Rakshit, TMH.

Reference Books:

1. Data Analytics using R, Seema Acharya, TMH.

Course Code: UGCA1947
Course Name: Digital Marketing

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	Learn how to use new media such as mobile, search and social networking.
CO2	Understand how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy.
CO3	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media.
CO4	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan

Detailed Contents	**Contact hours**
Unit-I **Introduction to Digital Marketing**	11

Difference between Traditional Marketing and Digital Marketing, Benefits of using Digital Media, Inbound and Outbound Marketing, Online marketing POEM: (Paid, Owned, and Earned Media), Components of Online Marketing (Email, Forum, Social network, Banner, Blog), Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing. **Email Marketing:** Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing **Social Media Marketing (SMM):** Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.	
Unit –II **Search Engine Optimisation (SEO)** About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO. **On-Page Optimization (Onsite):** Basics of Website Designing / Development; HTML Basics for SEO; Onsite Optimization Basics; Website Structure and Navigation Menu Optimization; SEO Content Writing. Keywords Research and Analysis (eg. SWOT analysis of website, finding appropriate keywords). **Off Page Optimization:** Introduction; Local marketing of websites depending on locations; Promoting Subsequent pages of the website. Introduction to organic SEO vs non-organic SEO; Social Media Optimization Techniques and Page Rank Technology.	**11**
Unit-III **Website Planning & Creation** **Content Marketing Strategy:** Goals and concepts, Strategic building blocks, Content creation & channel distribution, Tools of the trade, Advantages and challenges. **Keywords Research and Analysis:** Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools. **Web Presence:** How to increase online presence and drive more traffic for a website, Search result visibility in search engines for chosen keyword and phrases, Using e-mail marketing to drive traffic for a website, Posting social media content for lead generation, Tools to create and manage content, Use of Blogging as content strategy.	**12**

Creating content: Writing and posting content on the web and in social networks, blog and video; Create, manage and implement a content marketing strategy; Monitoring and recording results to improve content marketing campaigns; Successful content marketing strategies and case studies.	
Unit-IV **Online Advertising, Mobile Marketing and Web analytics** Introduction to Online Advertising and its advantages, Paid versus Organic, Pay Per Click (PPC) Model. Basic concepts Cost per Click (CPC), CPM, CTR, CR etc. About Mobile Marketing, Objectives of Mobile Advertising, Creating a Mobile Marketing Strategy, Introduction to SMS Marketing. About Web Analytics, Types of Web Analytics (On-site, Off-site), Importance of Web Analytics	**10**

Text Books:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, “Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing”, CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, “Digital Marketing Practice guide for SMB: SEO, SEM and SMM”, CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. " O'Reilly Media, Inc.".

E Books/ Online learning material:

1. www.sakshat.ac.in
2. https://swayam.gov.in
3. https://www.edx.org/course/online-marketing-strategies-curtinx- mkt5x
4. https://www.emarketinginstitute. org/free-courses/ eMarketing Institute

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Course Code: UGCA1953
Course Name: Digital Marketing Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Familiarizing with the key elements of a digital marketing strategy.
CO2	The students will be able to perform practical skills in common digital marketing tools such as SEO, Social media and Blogs.
CO3	Learn to manage the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media
CO4	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan

Instructions:

The instructor needs to give an overview of digital marketing with case studies	
1.	Explore Facebook, LinkedIn, Twitter, Video, Instagram, blog etc
2.	Explore Online Display Advertising, Ecommerce Marketing, Mobile Web and Content marketing.
3.	Explore Email Marketing; Google AdWords and Google Analytics
The instructor needs to discuss a case study using Search Engine Optimisation (SEO). Case Study – I : Student will plan and create a webpage will display Web presence	
4.	How to increase online presence and drive more traffic for a website.
5.	Search result visibility in Google for chosen keyword and phrases.
6.	Using e-mail marketing to drive traffic for a website.
7.	Posting social media content for lead generation.
8.	Tools to create and manage content.
9.	Use of Blogging as content strategy
Case Study – II : Student will plan and create a commercial website	
10.	Show results for Search Engine Algorithms & Page Rank Technology
11.	How to promote home page, SWOT Analysis of Website & finding right appropriate keywords.
12.	Monitoring and recording results to improve content marketing campaigns
13.	Writing and posting content on the web and in social networks.
Case Study – III : Student will identify an activity for Email/ Mobile/ Social Media Marketing	
14.	Create a Video/ YouTuber
15.	Manage a Video/ YouTuber platform and enhance viewership.

Texts Books:

1. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
2. Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford
3. Shivani Karwal, "Digital Marketing Handbook: A Guide to search Engine Optimization, Pay Per Click Marketing, Email Marketing and Content Marketing", CreateSpace Independent Publishing Platform, 1st edition.

Reference Books:

1. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
2. Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0: Moving from Traditional to Digital, Publication Wiley India Pvt Ltd.
3. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.
4. Enge, E., Spencer, S., Stricchiola, J., & Fishkin, R. (2012). The art of SEO. " O'Reilly Media, Inc.".

Course Code: UGCA1948
Course Name: Information Security

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Acquire a practical overview of the issues involved in the field of information security.
CO2	Demonstrate a basic understanding of the practice of information security.
CO3	To understand the information security risks across diverse settings including the Internet and WWW based commerce systems.

CO4	Explore the idea that in Information Security answers are not always known, and proposed solutions could give rise to new, equally complex problems.
CO5	Student will be able to develop the understating about information security

Detailed Contents	**Contact hours**
Unit –I **The Security Problem in Computing:** The meaning of computer Security, Computer Criminals, Methods of Defense, Elementary Cryptography: Substitution Ciphers, Transpositions, Making “Good” Encryption algorithms, Secure Architecture of an open System. DES and RSA Algorithm, Asymmetric and symmetric Key Cryptography, Role based Security, Digital Signatures, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption.	11
Unit-II **Security in Program and Operating System:** Secure Programs, Non malicious Program Errors, viruses and other malicious code, Targeted Malicious code, controls Against Program Threats, Protection in General- Purpose operating system protected objects and methods of protection memory and addmens protection, File protection Mechanisms, User Authentication Designing Trusted. **Operating System:** Security polices, models of security, trusted Operating System design, Assurance in trusted Operating System Implementation examples.	11
Unit-III **Database and Network Security:** Database Integration and Secrecy, Inferential Control, Sensitive data, Inference, multilevel database, proposals for multilevel security. Security in Network: Threats in Network, Network Security Controls, Firewalls, Intrusion Detection Systems,Secure E-Mail	11
Unit-IV **Administering Security:** Security Planning, Risk Analysis, Organizational Security policies, Physical Security. Legal Privacy and Ethical Issues in Computer Security: Protecting Programs and data, Information and the law, Rights of Employees and	11

Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case Studies of Corporate Security.	

Text Books

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate, Cryptography and Network Security, TMH.

Course Code: UGCA1954
Course Name: Information Security Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Acquire a practical overview of the issues involved in the field of information security.
CO2	Demonstrate a basic understanding of the practice of information security.
CO3	Explore the idea that in Information Security answers are not always known, and proposed solutions could give rise to new, equally complex problems.
CO4	Student will be able to develop the understating about information security

Instructions:

1	Study of System threat attacks - Denial of Services.
2	Study of Sniffing and Spoofing attacks.
3	Study of Techniques uses for Web Based Password Capturing.
4	Study of Different attacks causes by Virus and Trojans.
5	Study of Anti-Intrusion Technique – Honey pot.
6	Study of Symmetric Encryption Scheme – RC4.
7	Implementation of S-DES algorithm for data encryption
8	Implementation of Asymmetric Encryption Scheme – RSA.

9	Study of IP based Authentication.
10	Study of Cryptography Techniques
11	Study of Encryption algorithms
12	Study of Security polices
13	Study of Network Security Fundamentals, Ethical Hacking and Social Engineering

Reference Books:

1. Charles P.Pfleeger, Shari Lawrence. Security in Computing, Pfleeger. PHI.
2. Jason Andress. The Basics of Information Security, Syngress
3. Mark Stamp. Information Security: Principles and Practice, Wiley.
4. A. Kahate, Cryptography and Network Security, TMH.

Course Code: UGCA1949
Course Name: Cyber Laws & IPR

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Students locate and apply case law and common law to current legal dilemmas in the technology field.
CO3	Students will be able to understand the basics of the four primary forms of intellectual property rights.
CO4	Students will be able to compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Students will be able to analyze the effects of intellectual property rights on society as a whole.

Detailed Contents	**Contact hours**
Unit-I	12

Introduction Overview of Computer and Web Technology, Need for Cyber Law, Cyber Jurisprudence at International and Indian Level, Jurisdictional Aspects in Cyber Law Issues of jurisdiction in cyberspace, Types of jurisdiction, Minimum Contacts Theory, Sliding Scale Theory, Effects Test and International targeting, Jurisdiction under IT Act, 2000.	
Unit-II **Cyber Crimes& Legal Framework** Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Ethics and Etiquettes of Cyber World, Cyber Pornography, Identity Theft & Fraud, Cyber Terrorism, Cyber Defamation, Right to Privacy and Data Protection on Internet, Concept of privacy, Threat to privacy on internet, Self-regulation approach to privacy.	12
Unit-III **Overview of Intellectual Property** introduction and the need for intellectual property right (IPR), IPR in India – Genesis and Development IPR in abroad, Data Protection, Open Source Software, Macro economic impact of the patent system, Patent and kind of inventions protected by a patent, Patent document How to protect your inventions?, Granting of patent, Rights of a patent.	10
Unit-IV **Copyright, Related Rights and Trademarks** What is copyright? Latest editions of Designs, what is covered by copyright? How long does copyright last? Why protect copyright? What are related rights?, Distinction between related rights and copyright?, What is a trademark? Rights of trademark?, What kind of signs can be used as trademarks?, types of trademark, function does a trademark perform, How is a trademark protected?, How is a trademark registered?	10

Text Books

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.
4. Navneet Nagpal. Intellectual Property Right, Ebooks2go Inc.
5. Dr. S.K. singh. Intellectual Property Rights, Central Law Agency.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1955
Course Name: Cyber Laws & IPR Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6^{th}	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 60	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 40	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Students identify and analyze statutory, regulatory, constitutional, and organizational laws that affect the information technology professional.
CO2	Students locate and apply case law and common law to current legal dilemmas in the technology field.
CO3	Students will be able to understand the basics of the four primary forms of intellectual property rights.
CO4	Students will be able to compare and contrast the different forms of intellectual property protection in terms of their key differences and similarities.
CO5	Students will be able to analyze the effects of intellectual property rights on society as a whole.

Instructions:

1	Study of Jurisdictional Aspects in Cyber Law Issues
2	Study of Jurisdiction under IT Act, 2000.
3	Study of Hacking, Digital Forgery.
4	Study of threat to privacy on internet.
5	Study about the difference between related rights and copyright.
6	Study of Privacy and Data Protection on Internet.
7	Study about registration process of trademark.
8	Study about different kind of signs can be used as trademarks.
9	Study of Copyright, Related Rights and Trademarks.
10	Study of Self-regulation approach to privacy.
11	Study of intellectual property right (IPR) in India.
12	Study about impact of the patent system.
13	Study for Granting of patent.
14	Study related to Rights of Patents

15	Discussion with reference to authentication of Electronic Record using Digital Signatures

Reference Books:

1. Anirudh Rastogi. Cyber Law, LexisNexis.
2. Vakul Sharma. Information Technology Law and Practice Cyber Laws and Laws Relating to E-Commerce, Universal Law Publishing.
3. Pankaj Sharma. Information Security and Cyber Laws, Kataria, S. K., & Sons.
4. Navneet Nagpal. Intellectual Property Right, Ebooks2go Inc.
5. Dr. S.K. singh. Intellectual Property Rights, Central Law Agency.

Course Code: UGCA1950
Course Name: Machine Learning

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6^{th}	**Contact hours**: 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** 40%
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status**: Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	Know about the Learning methodologies of Artificial Neural Networks.
CO2	Learn the concept of clustering
CO3	Differentiate supervised and unsupervised learning
CO4	Understand the concept of Reinforcement learning

Detailed Contents	**Contact hours**
Unit-I **Introduction** What is Machine Learning, Unsupervised Learning, Reinforcement Learning Machine Learning Use-Cases, Machine Learning Process Flow, Machine Learning Categories, Linear regression and Gradient descent.	8
Unit-II **Supervised Learning**	12

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Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction Creating a Perfect Decision Tree, Confusion Matrix, Random Forest. What is Naïve Bayes, How Naïve Bayes works, Implementing Naïve Bayes Classifier, Support Vector Machine, Illustration how Support Vector Machine works, Hyper parameter Optimization, Grid Search Vs Random Search, Implementation of Support Vector Machine for Classification.	
Unit-III **Clustering** What is Clustering & its Use Cases, K-means Clustering, How does K-means algorithm work, C-means Clustering, Hierarchical Clustering, How Hierarchical Clustering works.	12
Unit-IV Why Reinforcement Learning, Elements of Reinforcement Learning, Exploration vs Exploitation dilemma, Epsilon Greedy Algorithm, Markov Decision Process (MDP) Q values and V values, Q – Learning, α values.	12

Text Books:

1. Pattern Reorganization and Machine learning by Christopher M. Bishop.
2. The elements of Statistical learning by Jeromeh. Friedman, Robert Tivshirani and Trevorhaspie.
3. Introduction to Machine Learning by Ethem Alpaydin. PHI Publisher.
4. Machine Learning, A practical approach on the statistical learinging theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.
5. Machine Learning A probabilistic prospective by Kevin P. Murphy

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Course Code: UGCA1956
Course Name: Machine Learning Laboratory

Program: BCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 6th	**Contact hours:** 4 hours per week
Internal max. marks: 70	**Theory/Practical**: Practical
External max. marks: 30	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:** Core

Prerequisite: Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.

Co requisite: Knowledge of Networking, Internet, Client Server concepts, Static & Dynamic environment of the websites etc.

Additional material required in ESE:

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the concepts of Machine Learning.
CO2	Design Python/Java programs for various Learning algorithms.
CO3	To implement basic algorithms in clustering & classification applied to text & numeric data
CO4	Identify and apply Machine Learning algorithms to solve real world problems.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Read the numeric data from .CSV file and use some basic operation on it.
2.	Write a program to demonstrate the working of the decision tree algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
3.	Write a program to demonstrate the working of the Random Forest algorithm.
4.	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
5.	Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
6.	Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
7.	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
8.	Write a program to demonstrate the working of the K-means clustering algorithm.
9.	Write a program to demonstrate the working of the Support Vector Machine for Classification Algorithm.
10.	Write a program to demonstrate the working of the Hierarchical Clustering

Reference Books:

1. Rodrigo fernandes de Mello and Moacir Antonelli Ponti., Machine Learning, A practical approach on the statistical learning
2. Christopher Bishop, "Pattern Recognition and Machine Learning" Springer, 2007.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Chapman and Hall, CRC Press, Second Edition, 2014.
4. Kevin P. Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012.
5. Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Third Edition, 2014
6. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997.

Course Code: UGCA1902
Course Name: Fundamentals of Computer and IT

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understanding the concept of input and output devices of Computers
CO2	Learn the functional units and classify types of computers, how they process information and how individual computers interact with other computing systems and devices.
CO3	Understand an operating system and its working, and solve common problems related to operating systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.
CO5	Study to use the Internet safely, legally, and responsibly

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. **Functional Units of Computer System:** CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. **Memory:** Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks. **Data Representation:** Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.	12
Unit-II **Concept of Computing & PC Software – I** **Concept of Computing, Types of Languages:** Machine, assembly and High level Language; Operating system as user interface, utility programs. **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.	12
Unit-III **PC Software – II** **Spreadsheet:** Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts & Graphs. **Presentation Graphics Software:** Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.	10
Unit-IV	10

The Impact of Computing and the Internet on Society **Electronic Payment System:** Secure Electronic Transaction, Types of Payment System: Digital Cash, Electronic Cheque, Smart Card, Credit/Debit Card E-Money, Bit Coins and Crypto currency, Electronic Fund Transfer (EFT), Unified Payment Interface (UPI), Immediate Payment System (IMPS), Digital Signature and Certification Authority. Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)	

Text Books:

1. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
2. Computer Fundamentals, A. Goel, 2010, Pearson Education.
3. Fundamentals of Computers, P. K.Sinha & P. Sinha, 2007, BPB Publishers.
4. IT Tools, R.K. Jain, Khanna Publishing House
5. “Introduction to Information Technology”, Satish Jain, Ambrish Rai & Shashi Singh, Paperback Edition, BPB Publications, 2014.

Reference Books:

1. “Introduction to Computers”, Peter Norton
2. Computers Today, D. H. Sanders, McGraw Hill.
3. “Computers”, Larry long & Nancy long, Twelfth edition, Prentice Hall.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning

E Books/ Online learning material

1. www.sakshat.ac.in
2. https://swayam.gov.in/course/4067-computer-fundamentals

Course Code: UGCA1903
Course Name: Problem Solving using C

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	**Course outcomes**
CO1	Student should be able to understand the logic building used in Programming.
CO2	Students should be able to write algorithms for solving various real life problems.
CO3	To convert algorithms into programs using C .

Detailed Contents	**Contact hours**
Unit-I **Logic Development:** Data Representation, Flowcharts, Problem Analysis, Decision Trees/Tables, Pseudo code and algorithms. Fundamentals: Character set, Identifiers and Key Words, Data types, Constants, Variables, Expressions, Statements, Symbolic Constants. **Operations and Expressions:** Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.	10
Unit-II **Data Input and Output:** formatted & unformatted input output. **Control Statements:** While, Do–while and For statements, Nested loops, If–else, Switch, Break – Continue statements.	10
Unit-III **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays. **Strings**: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.	12
Unit-IV **Structures & Unions:** Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions.	12

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Pointers: Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays **File Handling:** File Operations, Processing a Data File	

Text Books:

4. Programming in C, Atul Kahate
5. Programming in ANSI C, E. Balagurusami, Fourth Edition, Tata McGraw Hill
6. The C Programming Language, Kernighan & Richie, Second Edition, PHI Publication

Reference Books:

6. Object Oriented Programming, Lafore R, Third Edition, Galgotia Publications
7. Problem Solving and Programming in C, R.S. Salaria, Second Edition
8. Let us C,Yashvant P Kanetkar, Seventh Edition, BPB Publications, New Delhi.
9. Programming in C, Byron S. Gottfried, Second Edition, McGraw Hills.

Course Code: UGCA1909
Course Name: Object Oriented Programming using C++

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:** --
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

Detailed Contents	Contact hours
Unit-I	12

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Principles of object oriented programming Introduction to OOP and its basic features, Basic components of a C++, Program and program structure, Compiling and Executing C++ Program. Difference between Procedure Oriented Language(C) and Object Oriented Language	
Unit-II **Classes & Objects and Concept of Constructors** Defining classes, Defining member functions, Declaration of objects to class, Access to member variables from objects, Different forms of member functions, Access specifiers (Private, public, protected), Array of objects. Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.	10
Unit-III **Inheritance and Operator overloading** Introduction to Inheritance, Types of inheritance: - Single inheritance, Multiple inheritance, Multilevel inheritance, Hierarchical inheritance, Hybrid inheritance, Defining operator overloading, Overloading of Unary and Binary operators, Rules for overloading operators	12
Unit-IV **Polymorphism and File Handling** Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes. Opening and Closing File, Reading and Writing a file.	10

Text Books:

1. Object Oriented Programming with C++, E. Balagurusami, Fourth Edition, Tata Mc-Graw Hill.
2. Object Oriented Programming in Turbo C++, Robert Lafore, Fourth Edition Galgotia Publications.
3. The C++ Programming Language, Bjarna Stroustrup, Third Edition, Addison-Wesley Publishing Company.
4. Object Oriented Programming Using C++, Salaria, R. S, Fourth Edition, Khanna Book Publishing.

Course Code: UGCA1913
Course Name: Computer Networks

Program: BCA	**L:** 3 **T:** 1 **P:** 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks:60	**Elective status:** Elective
Total marks:100	

Prerequisite: Information Technology
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Be familiar with the different Network Models.
CO2	Understand different network technologies and their application.
CO3	Be updated with different advanced network technologies that can be used to connect different networks
CO4	Be familiar with various hardware and software that can help run a smooth network

Detailed Contents	Contact hours
Unit-I **Data communications concepts:** Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. **Types of Networks:** LAN, MAN, WAN **Network Topologies:** Bus, Star, Ring, Mesh, Tree, Hybrid **Communication Channels: Wired transmissions:** Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission. **Communication Switching Techniques**: Circuit Switching, Message Switching, Packet Switching.	12
Unit-II	10

Network Reference Models: OSI Reference Model, TCP/IP Reference Model, Comparison of OSI and TCP/IP Reference Models. Transmission impairments – Attenuation, Distortion, Noise. Multiplexing – Frequency division, Time division, Wavelength division. **Data Link Layer Design Issues**: Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)	
Unit-III **MAC sub layer:** CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring) **Network Layer:** Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.	12
Unit-IV **Transport Layer**: Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols. **Session, Presentation and Application Layers**: Session Layer – Design issues, remote procedure call. Presentation Layer – Design issues, Data compression techniques, Cryptography. Application Layer – Distributed application (client/server, peer to peer, cloud etc.), World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP), HTTP as an application layer protocol.	10

Text Books:

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

Reference Books:

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, “Computer Networking”, Pearson Education.
4. Douglas E. Comer, “Internetworking with TCP/IP”, Volume-I, Prentice Hall, India.

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Bachelor of Computer Applications (BCA)

Course Code: UGCA1922
Course Name: Database Management Systems

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand the basic concepts of DBMS.
CO2	Formulate, using SQL, solutions to a broad range of query and data update problems.
CO3	Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
CO4	Understand the concept of Transaction and Query processing in DBMS.

Detailed contents	Contact hours
Unit-I Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. Introduction to Data Models, Hierarchical, Network and Relational Model, Comparison of Network, Hierarchical and Relational Model, Entity Relationship Model.	10
Unit-II Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.	12
Unit-III Introduction to Normalization, First, Second, Third Normal Forms, Dependency Preservation, Boyce-Codd Normal Form, Multi-valued Dependencies and Fourth Normal Form, Join Dependencies and Fifth Normal Form, Domain-key normal form (DKNF).	12

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Unit-IV Database Recovery, Concurrency Management, Database Security, Integrity and Control. Structure of a Distributed Database, Design of Distributed Databases.	10

Text Books:

1. "An Introduction to Database System", Bipin C. Desai, Galgotia Publications Pvt Ltd-New Delhi, Revised Edition, (2012).

Reference Books:

1. "SQL, PL/SQL The Programming Language of Oracle", Ivan Bayross, BPB Publications, 4th Revised Edition (2009)
2. "An Introduction to Database Systems", C. J. Date, A. Kannan, S. Swamynathan, 8th Edition, Pearson Education, (2006).
3. "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudharshan, Tata McGraw Hill, 6th Edition, (2013).
4. Database Management Systems, Raghu Ramakrishnan, McGraw-Hill, Third Edition, 2014.

Course Code: UGCA1957
Course Name: Software Project Management

Program: BCA	**L**: 3 **T**: 1 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 6th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 60	**Elective status:** Elective
Total marks: 100	

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	Understand the principal tasks of software project managers, and basic concepts in software projects.
CO2	Explain the fundamentals of Process Planning, effort estimation and quality planning.
CO3	Plan software projects including risk and quality management.

CO4	Apply different management and development practices that affect software.

Detailed Contents	Contact hours
Unit-I Project Management Concepts, Processes and Project Management, Project Management and the CMM, The Project Management Process, The Process Database, The Process Capability Baseline, Process Assets and The Body of Knowledge System.	12
Unit-II The Development Process, Requirement Change Management, Estimation and Scheduling Concepts, Effort Estimation, Scheduling, The Bottom-up Estimation Approach, The Top-Down Estimation Approach, The Use Case Points Approach, Quality Concepts, Quantitative Quality Management Planning, Defect Prevention Planning.	12
Unit-III Concepts of Risks and Risk Management, Risk Assessment, Risk Control, Concepts in Measurement, Measurements, Project Tracking, Team Management, Customer Communication and Issue Resolution, The Structure of The Project Management Plan.	10
Unit-IV Concepts in Configuration Management, The Configuration Management Process, The Review Process, Data Collection, Monitoring and Control, Project Tracking, Defect Analysis and Prevention, Process Monitoring and Audit, Project Closure Analysis.	10

Text Books:

1. Software Project Management in Practice, Pankaj Jalote, 2002, Pearson Education.

Reference Books:

1. Software Engineering-A Practitioner's Approach, Roger S. Pressman, 2010, McGraw-Hill Higher Education, seventh edition.
2. Software Engineering, Ian Sommerville, 2009, Pearson Education.
3. Software Project Management, Bob Hughes, Mike Cotterell, Rajib Mall, McGraw-Hill, Sixth Edition, 2018.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

Semester III (Second year]

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME301-18	Fluid Mechanics	3	1	0	40	60	100	4
Professional Core courses	BTME302-18	Theory of Machines -I	3	1	0	40	60	100	4
Professional Core courses	BTME303-18	Machine Drawing	1	0	6	40	60	100	4
Professional Core courses	BTME304-18	Strength of Materials-I	3	1	0	40	60	100	4
Engineering Science courses	BTEC305-18	Basic Electronics Engineering	3	0	0	40	60	100	3
Professional Core courses	BTME305-18	Basic Thermodynamics	3	1	0	40	60	100	4
Professional Core courses	BTME306-18	Strength of Material (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME307-18	Theory of Machine (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME308-18	Fluid Mechanics (Lab)	0	0	2	30	20	50	1
Mandatory courses	BMPD301-18	Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
Total			16	4	14	330	420	750	26

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Semester IV (Second year]

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME401-18	Applied Thermodynamics	3	1	0	40	60	100	4
Professional Core courses	BTME402-18	Fluid Machines	3	1	0	40	60	100	4
Professional Core courses	BTME403-18	Strength of Materials-II	3	1	0	40	60	100	4
Engineering Science courses	BTME404-18	Materials Engineering	3	0	0	40	60	100	3
Professional Core courses	BTME405-18	Theory of Machines-II	3	1	0	40	60	100	4
Mandatory courses	EVS101-18	Environmental Science	3	-	-	100	0	100	0
Professional Core courses	BTME406-18	Applied Thermodynamics (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME407-18	Fluid Machines (Lab))	0	0	2	30	20	50	1
Professional Core courses	BTME408-18	Material Engineering (Lab)	0	0	2	30	20	50	1
Mandatory courses	BMPD401-18	Mentoring and Professional Development	0	0	2	Satisfactory / Un-Satisfactory			Non-Credit
Total			18	4	8	390	360	750	22

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Semester V (Third year)

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME501-18	Heat Transfer	4	1	0	40	60	100	5
Professional Core courses	BTME502-18	Design of Machine Elements	4	1	0	40	60	100	5
Professional Core courses	BTME503-18	Manufacturing Processes	4	0	0	40	60	100	4
Mandatory courses	BTME504-18	Management and Engineering Economics	3	0	0	40	60	100	3
Professional Core courses	BTME505-18	Heat Transfer (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME506-18	Manufacturing Processes (Lab)	0	0	2	30	20	50	1
Engineering Science courses	BTME507-18	Numerical Methods (Lab)	0	0	3	30	20	50	1.5
Mandatory courses	BTMC102-18	Essence of Indian knowledge Tradition	3	0	0	100	00	100	Non-Credit
	BTME409-18	4-weeks Industrial Training *	0	0	6	60	40	100	Non-credit
Total			18	2	13	410	340	750	20.5

* The grade of Satisfactory/ Un-satisfactory of Industrial/Institutional Training imparted at the end of 4th Semester will be included here.

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6th Semester Study Scheme

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME601-18	Refrigeration and Air conditioning	3	1	0	40	60	100	4
Professional Core courses	BTME602-18	Mechanical Measurements & Metrology	4	0	0	40	60	100	4
Professional Core courses	BTME603-18	Automobile Engineering	3	0	0	40	60	100	3
Mandatory courses	BTME604-18	Introduction to Industrial management.	3	1	0	40	60	100	4
Professional Elective		Elective-I	3	0	0	40	60	100	3
Professional Core courses	BTME605-18	Refrigeration and Air conditioning (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME606-18	Mechanical Measurements & Metrology (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME607-18	Auto. Engg. (Lab)	0	0	2	30	20	50	1
Professional Core courses	BTME608-18	Minor Project	0	0	2	30	20	50	1
Total			16	2	08	290	380	700	22

The project work will be carried out in parts as minor project in 6th semester and major project in 7/8th semester. The literature survey, problem formulation, assessment for viability of the project, objectives and methodology for the project shall be decided in 6th semester. The same project problem is to be extended in the major project in semester. The minor project may be carried out by a group of students 2 to 4.

List of Elective I, II and III (For 6th, 7th and 8th semester)

Sr. No.	Name of Subject	Subject Code
1)	Internal Combustion Engines.	BTME609-18
2)	Mechatronics Systems.	BTME610-18
3)	Microprocessor in Automation	BTME611-18
4)	Composite Materials	BTME612-18
5)	Computer Aided Design.	BTME613-18
6)	Product Design and Development	BTME614-18
7)	Non-Conventional Energy Resources.	BTME615-18
8)	Operation Research	BTME616-18
9)	Maintenance and Reliability	BTME617-18

Semester 7th / 8th

Course Type	Course Code	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
Professional Core courses	BTME701-18	Mechanical Vibrations	3	1	0	40	60	100	4
Professional Core courses	BTME702-18	Automation in Manufacturing	3	0	0	40	60	100	3
Professional Core courses	BTME703-18	Fundamentals of Management for Engineers	3	0	0	40	60	100	3
Professional Elective courses		Elective-II	3	0	0	40	60	100	3
Professional Elective courses		Elective-III	3	0	0	40	60	100	3
Choose from other department		Open Elective	3	0	0	40	60	100	3
	BTME704-18	Project-II	0	0	8	40	60	100	6
Total			18	1	8	280	420	700	25

Semester 7th / 8th

Course Code	Course Title	Evaluation Internal		External	Total Marks	Credits
		Institute	Industry			
BTME-801	Software Training	100	50	100	250	8
	Industrial Training	100	50	100	250	8
	Total	200	100	200	500	16

List of Open Elective Subject offered to other Departments :

Sr. No.	Name of Subject	Subject Code
1)	Internal Combustion Engines.	BTME609-18
2)	Mechatronics Systems.	BTME610-18
3)	Microprocessor in Automation	BTME611-18
4)	Composite Materials	BTME612-18
5)	Computer Aided Design.	BTME613-18
6)	Product Design and Development	BTME614-18
7)	Non-Conventional Energy Resources.	BTME615-18
8)	Operation Research	BTME616-18
9)	Maintenance and Reliability	BTME617-18

Subject offered for Minor Degree in B. Tech. Mechanical Engineering

Core Subjects

Sr. No.	Subject Code	Couse Title	Credits
1	BTME501-18	Manufacturing Processes	4

Elective Subject (Odd Semester)

Sr. No.	Subject Code	Couse Title	Credits
1	BTME301-18	Fluid Mechanics	4
2	BTME302-18	Theory of Machines-I	4
3	BTME304-18	Strength of Materials-I	4
4	BTME305-18	Basic Thermodynamics	4
5	BTME501-18	Heat Transfer	4

Elective Subject (Even Semester)

Sr. No.	Subject Code	Couse Title	Credits
1	BTME603-18	Automobile Engineering	4
2	BTME405-18	Theory of Machines-II	4
3	BTME403-18	Strength of Materials-II	4
4	BTME401-18	Applied Thermodynamics	4
5	BTME601-18	Refrigeration and Air Conditioning	4

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BTME301-18 FLUID MECHANICS

Course Outcomes:
After studying this course, students will be able to:

1. Understand the concept of fluids and their properties.
2. Apply the concept to solve the problems related to statics, dynamics and kinematics of fluids.
3. Use and apply dimensional analysis and similitude techniques to various physical fluid phenomena.
4. Distinguish various types of flows and learn flow measurement methods.

Detailed Contents:

1. Fundamentals of Fluid Mechanics: Introduction; Applications; Concept of fluid; Difference between solids, liquids and gases; Concept of continuum; Ideal and real fluids; Fluid properties: density, specific volume, specific weight, specific gravity, viscosity (dynamic and kinematic), vapour pressure, compressibility, bulk modulus, Mach number, surface tension and capillarity; Newtonian and non-Newtonian fluids. **02 Hrs**

2. Fluid Statics: Concept of static fluid pressure; Pascal's law and its engineering applications; Hydrostatic paradox; Action of fluid pressure on a plane submerged surface (horizontal, vertical and inclined): resultant force and centre of pressure; Force on a curved surface due to hydrostatic pressure; Buoyancy and flotation; Stability of floating and submerged bodies; Metacentric height and its determination; Periodic time of oscillation; Pressure distribution in a liquid subject to: (i) constant acceleration along horizontal, vertical and inclined direction (linear motion), (ii) constant rotation. **06 Hrs**

3. Fluid Kinematics: Classification of fluid flows; Lagrangian and Euler flow descriptions; Velocity and acceleration of fluid particle; Local and convective acceleration; Normal and tangential acceleration; Path line, streak line, streamline and timelines; Flow rate and discharge mean velocity; One dimensional continuity equation; Continuity equation in Cartesian (x,y,z), polar (r,θ) and cylindrical (r,θ,z) coordinates; Derivation of continuity equation using the Lagrangian method in Cartesian coordinates; Rotational flows: rotation, vorticity and circulation; Stream function and velocity potential function, and relationship between them; Flow net. **07 Hrs**

4. Fluid Dynamics: Derivation of Euler's equation of motion in Cartesian coordinates, and along a streamline; Derivation of Bernoulli's equation using principle of conservation of energy and equation of motionand its applications to steady state ideal and real fluid flows; Representation of energy changes in fluid system (hydraulic and energy gradient lines); Impulse momentum equation; Kinetic energy and momentum correction factors; Flow along a curved streamline; Free and forced vortex motions. **07 Hrs**

5. **Dimensional Analysis and Similitude:** Need of dimensional analysis; Fundamental and derived units; Dimensions and dimensional homogeneity; Rayleigh's and Buckingham's π - method for dimensional analysis; Dimensionless numbers (Reynolds, Froude, Euler, Mach, and Weber) and their significance; Need of similitude; Geometric, kinematic and dynamic similarity; Model and prototype studies; Similarity model laws. **04 Hrs**

6. **Internal Flows:** Laminar and Turbulent Flows: Reynolds number, critical velocity, critical Reynolds number, hydraulic diameter, flow regimes; Hagen – Poiseuille equation; Darcy equation; Head losses in pipes and pipe fittings; Flow through pipes in series and parallel; Concept of equivalent pipe; Roughness in pipes, Moody's chart. **06 Hrs**

7. **Pressure and Flow Measurement:** Manometers; Pitot tubes; Various hydraulic coefficients; Orifice meters; Venturi meters; Borda mouthpieces; Notches (rectangular, V and Trapezoidal) and weirs; Rotameters. **04 Hrs**

Suggested Readings / Books:

1. S.K. Som, G. Biswas and S. Chakraborty, "Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw Hill Publications, 3rd edition, 2011.
2. D.S. Kumar, "Fluid Mechanics and Fluid Power Engineering", S.K. Kataria and Sons Publishers, 1st Edition, 2009.
3. C.S.P. Ojha, R. Berndtsson and P.N. Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press,1st Edition, 2010.
4. Y.A. Cengel and J.M. Cimbala, "Fluid Mechanics - Fundamentals and Applications", Tata McGraw Hill Publications, 3rd Edition, 2013.
5. V.L. Streeter, E.B. Wylie and K.W. Bedford, "Fluid Mechanics", McGraw Hill BookCompany, New York, 9th Edition, 1998.
6. Frank M. White, "Fluid Mechanics", Tata Mc Graw Hill Publications, 5th Edition, 2012.

BTME302-18 THEORY OF MACHINES -I

Course Outcomes:

After studying this course, students will be able to:

1. Understand constructional and working features of important machine elements.
2. Design belt, rope and chain drives for transmission of motion from one shaft to another.
3. Identify different Cam and follower pairs for different applications and construct cam profile for required follower motion.
4. Understand the function of brakes, dynamometers, flywheel and governors.

Detailed Contents:

1. Basic Concept of machines: Link, Mechanism, Kinematic Pair and Kinematic Chain, Principles of Inversion, Inversion of a Four Bar Chain, Slider-Crank-Chain and Double Slider-Crank-Chain. Graphical and Analytical methods for finding: Displacement, Velocity, and Acceleration of mechanisms including Corliolis Components. **06 Hrs**

2. Lower and higher Pairs: Universal Joint, Calculation of maximum Torque, Steering Mechanisms including Ackerman and Davis approximate steering mechanism, Engine Indicator, Pentograph, Straight Line Mechanisms, Introduction to Higher Pairs with examples. **05 Hrs**

3. Belts, Ropes and Chains: Material & Types of belt, Flat and V-belts, Rope & Chain Drives, Idle Pulley, Intermediate or Counter Shaft Pulley, Angle and Right Angle Drive, Quarter Turn Drive, Velocity Ratio, Crowning of Pulley, Loose and fast pulley, stepped or cone pulleys, ratio of tension on tight and slack side of belts, Length of belt, Power transmitted by belts including consideration of Creep and Slip, Centrifugal Tensions and its effect on power transmission. **05 Hrs**

4. Cams: Types of cams and follower, definitions of terms connected with cams. Displacement,velocity and acceleration diagrams for cam followers. Analytical and Graphical design of camprofiles with various motions (SHM, uniform velocity, uniform acceleration and retardation,cycloidal Motion). Analysis of follower motion for circular, convex and tangent cam profiles. **05 Hrs**

5. Friction Devices: Concepts of friction and wear related to bearing and clutches. Types of brakes function of brakes. Braking of front and rear tyres of a vehicle. Determination of braking capacity, Types of dynamometers, (absorption, and transmission). **06 Hrs**

6. Flywheels: Turning moment and crank effort diagrams for reciprocating machines' Fluctuations of speed, coefficient of fluctuation of speed and energy, Determination of mass and dimensions of flywheel used for engines and punching machines. **03 Hrs**

7. Governors: Function, types and characteristics of governors. Watt, Porter and Proell governors. Hartnell and Willson-Hartnell spring loaded governors. Numerical problems related to these governors. Sensitivity, stability, isochronisms and hunting of governors. Governor effort and power, controlling force curve, effect of sleeve friction. **06 Hrs**

Suggested Readings / Books:

1. S. S. Rattan, Theory of Machines, Tata McGraw Hill, New Delhi.
2. Jagdish Lal, Theory of Mechanisms & Machines, Metropolitan Book Co.
3. Thomas Beven, Theory of Machines, Longman's Green & Co., London.
4. W. G. Green, Theory of Machines, Blackie & Sons, London
5. V.P. Singh, Theory of Machines, Dhanpat Rai.

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BTME303-18 MACHINE DRAWING

Course Outcomes:
After studying this course; the student will be able to:

1. Read, draw and interpret the machine drawings and related parameters.
2. Use standards used in machine drawings of machine components and assemblies.
3. Learn the concept of limits, fits and tolerances in various mating parts.
4. Visualize and generate different views of a component in the assembly.
5. Use CAD tools for making drawings of machine components and assemblies.

Note:

1. Drawing Practice is to be done as per IS code SP 46:2003 by Bureau of Indian Standards.
2. The Question paper shall have following structure/weightage:
   Section A – Short answer type Questions based upon whole syllabus – 10 question of 02 marks each (All questions are compulsory).
   Section B – Free hand sketching of machine parts etc.; – out of 03 questions of 05 marks each, 02 Questions are to be attempted.
   Section C – Assembly drawing (from Unit-III) of machine parts with at least two views (with bill of materials) – out of 02 questions of 30 marks each;01 question is to be attempted.

Detailed Contents:

1. Introduction: Classification of drawings, Principles of drawing, Requirements of machine Drawing, sectional views and conventional representation, dimensioning, concept of limits, fits & tolerances and their representation, machining symbols, various types of screw threads, types of nuts and bolts, screw fasteners, welded joints and riveted joints, introduction and familiarization of code SP 46:2003 by Bureau of Indian Standards. **15 Hrs**

2.Free hand sketches of:

a. **Couplings**: solid and rigid couplings, protected type flange coupling, pin type flexible coupling, muff coupling.
b. Knuckle and cotter joints.
c. **Pipe and Pipe fittings**: Flanged joints, spigot and socket joint, union joint, hydraulic and expansion joint. **15 Hrs**

3.Assembly of:

a. **IC Engine Parts:** piston and connecting rod.
b. **Boiler Mountings**: Steam stop valve, blow off cock, feed check valve and spring loaded safety valve.
c. **Bearing:** Swivel bearing, Plummer Block and Foot Step bearing.
d. **Miscellaneous:** Screw jack, Tail Stock and crane hook. **20 Hrs**

4. Practice using Computer Aided Drafting (CAD) tools for:

(a) Machine components, screw fasteners, Keys cotters and joint, shaft couplings, Pipe joints and fittings, riveted joints and welded Joints.

(b) Assemblies: - Bearings (Plumber Block, Footstep, Swivel), boiler mountings, screw jack, Exercise in computer Plots of drawing

(c) Case studies in computer plots and industrial blueprint **10 Hrs**

Suggested Reading/Books:

1. P.S Gill, "Machine Drawing", S K Kataria and sons, 18th edition, 2017 reprint
2. N.D.Bhatt, "Machine Drawing". Charotar publications, 49th edition, 2014
3. Ajeet Singh, "Machine Drawing (including Auto CAD)", Tata McGraw Hill, 2nd edition,2012
4. G. Pohit, "Machine Drawing with Auto CAD", Pearson Education Asia, 2007.
5. IS code SP 46(2003): Engineering Drawing Practice for schools and colleges by Bureau of Indian Standards.

Topic for Self-Learning (TSL)

1. Conventional representation of common feature like Springs, Gear Assembly, Braking of shaft, Pipe, Screw threads etc.
2. Drawing of special Types of bolts, nuts and washers.
3. Importance of bill of materials (BOM)
4. Free hand sketch of bearings (i.e. ball bearing and roller bearing).

BTME304-18 STRENGTH OF MATERIALS-I

Course Outcomes:

At the end of the course, the student will be able to

1. Understand the concepts of stress and strain at a point, in the members subjected to axial, bending, torsional loads and temperature changes.
2. Determine principal stresses, maximum shearing stress and their angles, and the stresses acting on any arbitrary plane within a structural element.
3. Find bending moment and shear force over the span of various beams subjected to different kinds of loads.
4. Calculate load carrying capacity of columns and struts and their buckling strength.
5. Evaluate the slope and deflection of beams subjected to loads.

Detailed Contents:

1. Simple, Compound Stresses and Strains: Stress and Strain and their types, Hook's law, longitudinal and lateral strain, Poisson's ratio, stress-strain diagram for ductile and brittle materials, extension of a bar due to without and with self weight, bar of uniform strength, stress in a bar, elastic constants and their significance, relation between elastic constants, Young's modulus of elasticity, modulus of rigidity and bulk modulus. Temperature stress and strain calculation due to axial load and variation of temperature in single and compound bars. Two-dimensional stress system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress. Generalized Hook's law, principal stresses related to principal strains. **08 Hrs**

2. Bending Moment (B.M) and Shear Force (S.F) Diagrams: S.F and B.M definitions; relation between load, shear force and bending moment; B.M and S.F diagrams for cantilevers, simply supported beams with or without overhangs, and calculation of maximum B.M and S.F and the point of contra flexure under different loads: Concentrated loads, Uniformity distributed loads over the whole span or part of span, Combination of concentrated and uniformly distributed load, Uniformly varying loads and Application of moments. **06 Hrs**

3. Bending Stresses in Beams: Assumptions in the simple bending theory; derivation of formula and its application to beams of rectangular, circular and channel, I and T- sections. Combined direct and bending stresses in afore-mentioned sections, composite / flitched beams. **05 Hrs**

4. Torsion: Derivation of torsion equation and its assumptions and its application to the hollow and solid circular shafts. Torsional rigidity, combined torsion and bending of circular shafts; principal stress and maximum shear stresses under combined loading of bending and torsion. **05 Hrs**

5. **Columns and struts**: Introduction, failure of columns, Euler's formula, Rankine-Gordon's formula, Johnson's empirical formula for axially loaded columns and their applications.
05 Hrs

6. **Slope and deflection**: Relationship between moment, slope and deflection; method of integration, Macaulay's method, moment area method and use of these methods to calculate slope and deflection for: Cantilevers, Simply supported beams with or without overhang, Under concentrated loads, uniformly distributed loads or combination of concentrated &uniformly distributed loads. **07 Hrs**

Suggested Readings/Books:

1. Timoshenko and Gere, "Mechanics of Materials", CBS Publishers and Distributors, New Delhi.
2. Pytel&Kiusalaas, "Mechanics of Materials", Cengage Learning, New Delhi.
3. S. S. Rattan, "Strength of Materials", Tata McGraw Hill, New Delhi.
4. R. K. Bansal, "A Text Book of Strength of Materials", Laxmi Publications, New Delhi.
5. D. K. Singh, "Strength of Materials", Ane Books Pvt. Ltd., New Delhi.
6. Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.

BTEC305-18 BASIC ELECTRONICS ENGINEERING

Course Objectives:
The objective of this Course is to provide the students of B.Tech Mechanical Engineering with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the basic Electronics devices.

Course Outcomes:
After undergoing this course students will be able to

1. Understand construction of diodes and their rectifier applications.
2. Appreciate the construction and working bipolar junction transistors and MOSFETs.
3. Design Op-Amp IC based fundamental applications.
4. Comprehend working of basic elements of digital electronics and circuits.

Unit I: **Semiconductor Diodes and Applications** - Semiconductor Diode - Ideal versus Practical, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications;

Unit II: **Transistors & Amplifiers** - Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Distortion, Operating Point, Voltage Divider Bias Configuration; Introduction to nMOS and pMOS.

Unit III: Operational Amplifiers and Applications - Introduction to Op-Amp, Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Differentiator and Integrator, Square Wave and Triangular Wave Generation.

Unit IV: Digital Electronics -Boolean Algebra - Binary, Octal, Hexadecimal Number Systems, Addition, Subtraction using 1's and 2's compliment method, Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); K-Map simplification Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop.

<u>Text/Reference Books:</u>

2. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
3. SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.
4. Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.
5. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH
6. R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson.

BTME305-18 BASIC THERMODYNAMICS

Course Objectives:

The course has been designed to cover the interconversion of heat energy into work energy and vice versa; balance of energy between the System and its Surroundings; to learn about the application of First and Second law to various thermodynamic Systems, to learn about gas power cycles and IC Engines, to learn about steam formation and its properties, to learn about vapor power cycles.

Course Outcomes:

1. Apply energy balance to Systems and Control Volumes in situations involving heat and work interactions.
2. Evaluate changes in thermodynamic properties of substances.
3. Evaluate performance of energy conversion devices.
4. Explain and apply various gas power and vapor power cycles.

1. Basic Concepts

Definition of thermodynamics, Concept of Thermodynamic System and of thermodynamic equilibrium, Boundary and Surroundings; Open, Closed and Isolated Systems. Property, state, path, process and cycle; dot/point functions and path functions, Phase and pure substances, Equation of State, reversible, Quasi-static and irreversible processes; Energy and its forms, Energy transfer across the System boundaries. Types of work transfer, heat and work; sign conventions for heat and work interaction, Concept of temperature and heat, microscopic and macroscopic approach, Concept of continuum, Zeroth law of thermodynamics. Concept of thermal equilibrium and principles of thermometry. Ideal gas and characteristic gas equation. (4)

2. First Law of Thermodynamics

Concept of First law of thermodynamics, essence and corollaries of First law; internal energy and enthalpy, analysis of non flow and flow processes for an ideal gas for constant volume(*isochoric*), constant pressure(*isobaric*), constant temperature(*isothermal)*, adiabatic and polytropic processes. Changes in various properties, work done and heat exchange during these processes, free expansion and throtting process and its applications in Engineering processes; Steady Flow Energy Equation and its application to various thermodynamic Systems(ie, in *engineering devices*); (8)

3. Second Law of Thermodynamics

Limitations of First law of thermodynamics, concept of Kelvin Plank and Clausius statements of the Second law and their ***equivalence*** *and* their application *to Refrigerator*, *Heat Pump and Heat Engine*. Thermodynamic temperature scale, Efficiency and philosophy of Carnot cycle and its consequences, Carnot Engine and Carnot theorem; Carnot refrigerator, Heat Pump and Heat Engines. Clausius theorem; Clausius inequality; concept of entropy, principle of increase in entropy, representation of various processes on T-S coordinates and change in entropy for different processes, concept of entropy generation in Closed and Open systems, high grade and low grade energy, available and unavailable energy; availability and unavailability, Second law efficiency and energy analysis of Thermodynamic Systems, Third law of Thermodynamics (definition only). (8)

4. Gas Power Cycles

Air-standard efficiency, Nomenclature of Piston-Cylinder arrangement w.r.t. swept volume; clearance volume, compression ratio and mean effective pressure; Analysis and philosophy of Air-Standard Cycles i.e. Otto Cycle, Diesel Cycle and Dual Cycle; their compression ratio, mean effective pressure, power output and Efficiency; Comparison between the three Cycles. (9)

5. Internal Combustion Engines

Classification and application, constructional and working details of two stroke and four stroke cycle engines.

6. Properties of Steam

Pure Substance; steam formation at constant pressure and the properties of steam; use of steam tables, constant volume, constant pressure and isentropic process, simple Ranking cycle. Construction, working, classification and applications of gas turbines, comparison of gas turbines with steam turbines and IC engines, performance analysis of constant pressure gas turbine cycle (Brayton cycle), thermal refinements like regeneration, inter-cooling and re-heating, selection

Suggested Books:

1. Sonntag R. E, Borgnakke C. and Van Wylen G. J., Fundamentals of Thermodynamics, Wiley India Pvt. Ltd.
2. Jones, J. B. and Duggan R. E., Engineering Thermodynamics, Prentice-Hall of India.
3. Moran M. J. and Shapiro H. N., Fundamentals of Engineering Thermodynamics, John Wiley and Sons.
4. Nag P.K., Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd.
5. Mahesh Rathore, Thermal Engineering, McGraw-Hill Education (India) Pvt. Ltd.
6. R. Yadav, Sanjay and Rajay, Applied Thermodynamics, Central Publishing House.

BTME306-18 Strength of Material Lab

Course Outcomes:

After studying this course, students shall be able to:

1. Measure the various mechanical properties such as tensile and compressive strength, impact strength, torsion strength and fatigue strength and hardness of brittle and ductile materials.
2. Calculate load carrying capacity of long columns and their buckling strength.

List of Practical

1 To perform tensile and compression test in ductile and brittle materials and to draw stress-strain curve and to determine various mechanical properties.

2 To perform compression test on Cast Iron

3 To perform any hardness tests (Any one from Rockwell, Brinell &Vicker's test).

4 To perform impact test to determine impact strength.

5 To perform torsion test and to determine various mechanical properties.

6 To perform Fatigue test on circular test piece.

7 To perform bending test on beam and to determine the Young's modulus and modulus of rupture.

8 Determination of Bucking loads of long columns with different end conditions.

9 To evaluate the stiffness and modulus of rigidity of helical coil spring.

BTME307-18 Theory of Machine (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Determine gyroscopic couple, balancing of rotating masses and Cam profile analysis.
2. Determine gear- train value of compound gear trains and epicyclic gear trains.

List of Practical

1 To draw displacement, velocity & acceleration diagram of slider - crank and four bar mechanism.

2 To study the various inversions of kinematic chains

3 Conduct experiments on various types of governors and draw graphs between height and equilibrium speed of a governor

4 Determination of gyroscopic couple (graphical method).

5 Balancing of rotating masses (graphical method).

6 Cam profile analysis (graphical method)

7 Determination of gear- train value of compound gear trains and epicyclic gear trains.

8 To draw circumferential and axial pressure profile in a full journal bearing.

9 To determine coefficient of friction for a belt-pulley material combination.

10 Determination of moment of inertia of flywheel.

BTME308-18 Fluid Mechanics (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Distinguish various type of flows and flow measurement methods and concept of statics and dynamics of liquids.
2. Determine discharge and head loss, hydraulic and friction coefficient, for different types of flow in pipe and open channels.

List of Practical

1 To determine the metacentric height of a floating vessel under loaded and unloaded conditions.
2 To study the flow through a variable area duct and verify Bernoulli's energy equation.
3 To determine the coefficient of discharge for an obstruction flow meter (venturi meter/ orifice meter.
4 To determine the discharge coefficient for a V- notch or rectangular notch.
5 To study the transition from laminar to turbulent flow and to ascertain the lower critical Reynolds number.
6 To determine the hydraulic coefficients for flow through an orifice.
7 To determine the friction coefficients for pipes of different diameters.
8 To determine the head loss in a pipe line due to sudden expansion/ sudden contraction/ bend.
9 To determine the velocity distribution for pipeline flow with a pitot static probe.
10 Experimental evaluation of free and forced vortex flow

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

BTME401-18 APPLIED THERMODYNAMICS

Course Outcomes:

After studying this course, students will be able to:

1. Learn the functioning and performance evaluation of reciprocating air compressors.
2. Analyze the combustion phenomenon in boilers and I.C. engines.
3. Use of Steam Tables and MollierChart to solve vapour power cycle problems.
4. Explain the constructional features and working of steam power plants and to evaluate their performance.

1. Reciprocating Air Compressors:-Single stage single acting reciprocating compressor(*with* and ***without clearance volume*)**: construction, operation, work input and best value of index of compression, heat rejected to cooling medium, isothermal, overall thermal, isentropic, polytropic and mechanical efficiency, Clearance volumetric efficiency, Overall volumetric efficiency, effect of various parameters on volumetric efficiency, free air delivery; **Multistage compressors:** purpose and advantages, construction and operation, work input, heat rejected in intercoolers, minimum work input, optimum pressure ratio; isothermal, overall thermal, isentropic, polytropic and mechanical efficiencies; Performance curves. **5 Hrs**

2. Thermodynamics of Combustion in Boilers and IC Engines: Principle of Combustion; Stoichio-metric and non-stoichiometeric combustion; Combusion Problems in boilers & IC Engines; Calculations of air fuel ratio: Analysis of products of combustion, conversion of volumetric analysis into gravimetric analysis and vice versa, Actual weight of air supplied, use of mols. for solution of combustion problems; Heat of formation; Enthalpy of formation; Enthalpy of reaction/combustion and it's evaluation; first law analysis of reacting system: steady flow and Closed Systems, adiabatic flame temperature and its determination. Various stages of combustion in IC Engines.

5 Hrs

3. Steam: Properties of Steam Pure substance ; Steam and its formation at constant pressure: wet, dry and super-heated(*super-saturated*) steam; Sensible heat*(sensible enthalpy)*, latent heat(*latent enthalpy*) and total/stagnation heat(*total/stagnation enthalpy*) of steam; dryness fraction and its determination; degree of superheat and degree of sub-cool; Entropy and Internal energy of steam; Use of Steam Tables and Mollier Charts; Basic thermodynamic processes with steam(isochoric, isobaric, isothermal, isentropic and adiabatic processes) and their representation on T-S Charts and Mollier Charts(**h-s** diagrams), significance of Mollier Charts. **5 Hrs**

4. Vapour Power Cycle: Carnot Cycle and its limitations; Rankine steam power cycle, Ideal and actual; Mean temperature of heat addition; Effect of pressure, temperature and vacuum on Rankine Efficiency; Rankine Cycle Efficiency and methods of improving Rankine efficiency: Reheat cycle, Bleeding(*feed-water-heating*), Regenerative Cycle, Combined reheat-regenerative cycle; Ideal working fluid; Binary vapour cycle, Combined power and heating cycles. 5 Hrs

5. SteamNozzles: Definition, types and utility of nozzles; Flow of steam through nozzles; Condition for maximum discharge through nozzle; Critical pressure ratio, its significance and its effect on discharge; Areas of throat and at exit for maximum discharge; Effect of friction; Nozzle efficiency; Convergent and Convergent-divergent nozzles. Calculation of Nozzle dimensions(length and diameters of throat and exit); Supersaturated(or metastable) flow through nozzle.
5 Hrs

6. Steam Turbines(Impulse Turbine): Introduction; Classification; Impulse v/s Reaction turbines. Simple **impulse/De Level** turbine: Pressure and velocity variation, Compounding of impulse turbines: purpose types; pressure and velocity variation, velocity diagrams/triangles; Combined velocity diagram/triangles and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, maximum work and maximum efficiency, overall efficiency and relative efficiency, effect of blade friction on velocity diagram, effect of speed ratio on blade efficiency, condition for axial discharge.
5 Hrs

7. Reaction Turbine:- Pressure and velocity variation, velocity diagrams/triangles, Degree of reaction, combined velocity diagram/triangles and calculations for force, axial thrust, work, power, blade efficiency, stage efficiency, overall efficiency and relative efficiency, maximum work and maximum efficiency; Calculations of blade height; **Multistaging:** Overall efficiency and relative efficiency; Reheating, Reheat factor and condition curve; Losses in steam turbines; Back pressure and extraction Turbines ; Co-generation; Economic assessment; Governing of steam turbines.
5 Hrs

8. Steam Condensers:- Function; Elements of condensing unit; Types of condensers; Dalton's law of partial pressures applied to the condenser problems; Condenser and vacuum efficiencies; Cooling water calculations; Effect of air leakage; Method to check and prevent air infiltration; Description of air pump and calculation of its capacity; **Cooling towers**: function, types and their operation.

5 Hrs

Suggested Books:

1. R. Yadav, “Applied Thermodynamics”, Central Publishing House , Allahabad.
2. D.S. Kumar and V.P. Vasandani, “Heat Engineering”, Metropolitan Book Co. Pvt. Ltd.
3. G Rogers and Y.Mayhew , “Engineering Thermodynamics”, Pearson, Wesley Longman (Singapore) Pte, 482 F.I.E Patparganj, Delhi-110 092.
4. W.A.J. Keartan, Steam Turbine: , “Theory and Practice”, ELBS Series.
5. V. Ganeshan, “Internal Combustion Engines”, Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
6. P.K.Nag, “Basic & Applied Thermodynamics”, Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
7. P.K. Nag, “Engineering Thermodynamics”, Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
8. E.F. Obert, “Concepts of Thermodynamics”, Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110 008.
9. C.P. Arora, “Thermodynamics”, Tata McGraw Hill Education Pvt. Ltd., 7 West Patel Nagar, New Delhi-110008.

BTME402-18 FLUID MACHINES

Course Outcomes:

After studying this course, students shall be able to:

1. Recognize basic components of turbo machines and understand related fundamental laws/ principles and apply these for calculation of various parameters like work done, force efficiency etc.
2. Know about constructional details, working and design aspects of runner/wheel and evaluate the performance of various turbines like Pelton, Kaplan and Francis.
3. Know about constructional details, working and evaluate the performance of centrifugal pump under different vane shape conditions.
4. Know about constructional details, working and evaluate the performance of reciprocating pump and evaluate the effect of various deviations from the ideal conditions on the work done.
5. Know about constructional details and working of hydraulic devices like fluid coupling, accumulator and intensifier.

Detailed Contents:

1. General Concepts: Impulse momentum principle; jet impingement on stationary and moving flat plates; and on stationary or moving vanes with jet striking at the centre and tangentially at one end of the vane; calculations for force exerted; work done and efficiency of jet. Basic components of a turbo machine and its classification on the basis of purpose; fluid dynamic action; operating principle; geometrical features; path followed by the fluid. Euler's equation for energy transfer in a turbo machine and specifying the energy transfer in terms of fluid and rotor kinetic energy changes. **07 Hrs**

2. Pelton Turbine: Component parts and operation; velocity triangles; work output; Effective head; available power and efficiency; design aspects such as mean diameter of wheel; jet ratio; number of jets; number of buckets with working proportions; governing of Pelton turbine. **05 Hrs**

3. Francis and Kaplan Turbines: Component parts and operation velocity triangles and work output; working proportions and design parameters for the runner; Degree of reaction; Draft tubes - its function and types. Function and brief description of commonly used surge tanks; governing of reaction turbines. **06 Hrs**

4. Centrifugal Pumps: Layout and installation; Main elements and their functions; Various types and classification; Pressure changes in a pump; Heads of a pump - suction; delivery; static; manometric; total; net positive suction head and Euler’s head; vane shape and its effect on head-capacity relationships; Departure from Euler's theory and losses; pump output and efficiency; Minimum starting speed and impeller diameters at the inner and outer periphery; model testing and Priming and priming devices; Multistage pumps - series and parallel arrangement; submersible pumps. Construction and operation; Axial and mixed flow pumps; Trouble shooting - field problems; causes and remedies. **06 Hrs**

5. Similarity Relations and Performance Characteristics: Unit quantities; specific speed and model relationships; scale effect; Cavitation and Thomas's cavitation number; Concept of Net PositiveSuction Head (NPSH) and its application. **04 Hrs**

6. Reciprocating Pumps: Introduction to single acting and double acting reciprocating pumps; their components; and parts and working; pressure variations due to piston acceleration; acceleration effects in suction and delivery pipes; work done against friction; maximum permissible vacuum during suction stroke; Functions of Air vessels. **05 Hrs**

7. Hydraulic Devices and Systems: Construction; operation and utility of simple and differential accumulator; intensifier; fluid coupling and torque converter; Air lift and jet pumps; gear; vane and piston pumps; Hydraulic Ram; Hydraulic lift; Hydraulic crane and Hydraulic press. **03 Hrs**

Suggested Reading/ Books:

1. R.L. Daughaty, Hydraulic Turbines, McGraw Hill
2. Jagdish Lal, Hydraulic Machines by Metropolitan Book Co
3. D.S. Kumar, Fluid Mechanics and Fluid Power Engineering, SK Kataria and Sons,
4. K. Subramaniam, Hydraulic Machines, Tata Mc Graw Hill
5. R.K. Purohit., Hydraulic Machines, Scientific Publishers
6. C.S.P.Ojha, R.Berndtsson, P.Chandramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010

BTME403-18 STRENGTH OF MATERIALS II

Course Outcomes:

At the end of the course, the student will be able to:

1. Apply the basics to find stresses in various applications (shells, curved beams and rotating discs).
2. Analyse the change in dimensions of shells, curved beams and rotating discs under operation.
3. Determine stresses, deflection and energy stored in various kinds of springs subjected to load and twist.
4. Understand the concept of failure theories and strain energy.
5. Evaluate shearing stress variation in beams of different cross-section and materials.

Detailed Contents:

1. **Strain Energy:** Introduction to strain energy, energy of dilation and distortion. Resilience, stress due to suddenly applied loads. Castigliano's and Maxwell's theorem of reciprocal deflection. **05 Hrs**

2. **Theories of Failure**: Maximum principal stress theory, maximum shear stress theory, maximum principal strain theory, total strain energy theory, shear strain energy theory. Graphical representation and derivation of equation for these theories and their application to problems related to two-dimensional stress systems. **05 Hrs**

3. **Springs:** Open and closed coiled helical springs under the action of axial load and/or couple. Flat spiral springs- derivation of formula for strain energy, maximum stress and rotation. Leaf spring deflection and bending stresses. **05 Hrs**

4. **Thin Cylinders and Spheres**: Calculation of Hoop stress, longitudinal stress in a cylinder, effects of joints, change in diameter, length and internal volume. Principal stresses in sphere, change in diameter and internal volume. **05 Hrs**

5. **Thick Cylinders**: Derivation of Lame's equations, calculation of radial, longitudinal and hoop stresses and strains due to internal pressure in thick cylinders, compound cylinders, hub shrunk on solid shafts, shrinkage allowance and shrinkage stress. **05 Hrs**

6. **Bending of Curved Beams**: Calculation of stresses in cranes or chain hooks, rings of circular and trapezoidal section, and chain links with straight sides. **04 Hrs**

7. **Shear Stresses in Beams**: Shear stress distribution in rectangular, circular, I, T and channel section; built up beams. Shear centre and its importance. **04 Hrs**

8. **Rotational Discs:** Stresses in rotating discs and rims of uniform thickness; disc of uniform strength. **03 Hrs**

Suggested Readings/Books:

1. S. S. Rattan, “Strength of Materials”, Tata McGraw Hill, New Delhi.
2. R. K. Bansal, “A Text Book of Strength of Materials”, Laxmi Publications, New Delhi.
3. Sadhu Singh, Strength of Materials, Khanna Publishers, Delhi.
4. Kirpal Singh, “Mechanics of Materials”, Standard Publishers, New Delhi.
5. R.S. Lehri, “Strength of Materials”, Katson Publishers, New Delhi.

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BTME404-18 MATERIALS ENGINEERING

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the significance of structure-property-correlation for engineering materials including ferrous and nonferrous.
2. Explain the use and importance of various heat treatment processes used for engineering materials and their practical applications.
3. Understand the various structural changes occurred in metals with respect to time temperature transformations.
4. Understand the significance of Fe-C and TTT diagram for controlling the desired structure and properties of the materials.

Detailed Content:

1. Crystallography: Atomic structure of metals, atomic bonding in solids, crystal structures, crystallattice of body centered cubic, face centered cubic, closed packed hexagonal; crystalline and noncrystalline materials; crystallographic notation of atomic planes; polymorphism and allotropy; imperfection in solids: theoretical yield strength, point defects, line defects and dislocations, interfacial defects, bulk or volume defects. Diffusion: diffusion mechanisms, steady-state and nonsteady-state diffusion, factors affecting diffusion. Theories of plastic deformation, recovery,re-crystallization. **12 Hrs**

2. Phase Transformation: General principles of phase transformation in alloys, phase rule andequilibrium diagrams, Equilibrium diagrams of Binary systems. Iron carbon equilibrium diagramand various phase transformations. Time temperature transformation curves (TTT curves): fundamentals, construction and applications. **09 Hrs**

3. Heat Treatment: Principles and applications. Processes viz. annealing, normalizing, hardening, tempering. Surface hardening of steels: Principles of induction and oxyacetylene flame hardening.Procedure for carburising, nitriding and cyaniding. Harden-ability: determination of harden-ability.Jominy end-quench test. Defects due to heat treatment and their remedies; effects produced byalloying elements. Composition of alloy steels. **09 Hrs**

4. Ferrous Metals and Their Alloys: Introduction, classification, composition of alloys, effect ofalloying elements (Si, Mn, Ni, Cr, Mo, W, Al) on the structures and properties of steel. **06 Hrs**

Suggested Readings / Books:

1. B. Zakharov, Heat Treatment of Metals, University Press.
2. T. Goel and R.S. Walia, Engineering Materials & Metallurgy.
3. Sidney H Avner, Introduction to Physical Metallurgy, Tata Mcgraw-Hill.
4. V. Raghavan, Physical Metallurgy: Principles and Practice, PHI Learning.
5. Y. Lakhin , Engineering Physical Metallurgy, Mir Publishers

BTME405-18 THEORY OF MACHINES-II

Course Outcomes:

After studying this course, students will be able to:

1. Understand the basic concepts of inertia forces & couples applied to reciprocating parts of a machine.
2. Understand balancing of rotating and reciprocating parts of machines.
3. Select suitable type of gears for different application and analyse the motion of different elements of gear trains.
4. Understand the concept and application of gyroscopic effect.
5. Gain knowledge of kinematic synthesis.

Detailed Contents:

1. Static force analysis: Concept of force and couple, free body diagram, condition of equilibrium, static equilibrium of mechanism, methods of static force analysis of simple mechanisms. Power transmission elements, considerations of frictional forces. **05 Hrs**

2. Dynamic force analysis Determination of forces and couples for a crank, inertia of reciprocating parts, dynamically equivalent system, analytical and graphical method, inertia force analysis of basic engine mechanism, torque required to overcome inertia and gravitational force of a four-bar linkage. **05 Hrs**

3. Balancing: Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses,and condition of balance in multi cylinder in line V-engines, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors. **06 Hrs**

4. Gears: Toothed gears, types of toothed gears and its terminology. Path of contact, arc of contact, conditions for correct gearing, forms of teeth, involutes and its variants, interference and methods of its removal. Calculation of minimum number of teeth on pinion/wheel for involute rack, helical, spiral, bevel and worm gears. Center distance for spiral gears and efficiency of spiral gears. **07 Hrs**

5. Gear Trains: Types of gear trains, simple, compound and epicyclic gear trains, problems involving their applications, estimation of velocity ratio of worm and worm wheel. **05 Hrs**

6. Gyroscopic motion and couples: Effect on supporting and holding structures of machines. stabilization of ships and planes, Gyroscopic effect on two and four wheeled vehicles. **03 Hrs**

7. Kinematic synthesis of Mechanism: Freudenstien equation, Function generation errors in synthesis, two- and three-point synthesis Transmission angles, least square technique. **05 Hrs**

Suggested Readings / Books:

1. S.S. Rattan, Theory of Machines, Tata Mc. Graw Hill.
2. John, Gordon, and Joseph, Theory of Machines and Mechanisms, Oxford University Press.
3. Hams Crone and Roggers, Theory of Machines.
4. Shigley, Theory of Machines, Mc Graw Hill.
5. V.P. Singh, Theory of Machines, Dhanpat Rai and Sons.

BTME406-18 Applied Thermodynamics (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Understand the construction and working of IC engines, and evaluate their performance.
2. Identify the various types of boilers & condensers.

List of Practical

1 Study of construction and operation of 2 stroke and 4 stroke Petrol and Diesel engines using actual engines or models.

2 To plot actual valve timing diagram of a 4 stroke petrol and diesel engines and study its impact on the performance of engine.Study of working, construction, mountings and accessories of various types of boilers.

3 Study of working, construction, mountings and accessories of various types of boilers.

4 To perform a boiler trial to estimate equivalent evaporation and efficiency of a fire tube/ water tube boiler.

5 Determination of dryness fraction of steam and estimation of brake power, Rankine efficiency, relative efficiency, generator efficiency, and overall efficiency of an impulse steam turbine and to plot a Willian's line.

6 Determine the brake power, indicated power, friction power and mechanical efficiency of a multi cylinder petrol engine running at constant speed (Morse Test).

7 Performance testing of a Petrol and Diesel engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emission. Draw/obtain power consumption and exhaust emission curves. Also make the heat balance sheet.

8 Performance testing of a petrol engine from no load to full load (at constant speed) for a single cylinder/ multi- cylinder engine in terms of brake power, indicated power, mechanical efficiency and specific fuel consumption and to measure the exhaust emissions. Also draw/obtain power consumption and exhaust emission curves.

9 Study of construction and operation of various types of steam condensers and cooling towers.

BTME407-18 Fluid Machines (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Conduct experiments on scaled down models or on actual size hydraulic machines and evaluate results in terms of unit or specific quantities for comparison purpose.
2. Understand the working of various hydraulic machines (turbines and pumps) and can suggest remedial solutions for various faults.

List of Practical

1	Determination of various efficiencies of Hydraulic Ram
2	To draw characteristics of Francis turbine/Kaplan Turbine
3	To study the constructional features of reciprocating pump and to perform test on it for determination of pump performance
4	To draw the characteristics of Pelton Turbine
5	To draw the various characteristics of Centrifugal pump
6	Determine the effect of vane shape and vane angle on the performance of centrifugal fan/Blower
7	A visit to any Hydroelectric Power Station

BTME408-18 Material Engineering (Lab)

Course Outcomes:

After studying this course, students shall be able to:

1. Analyse the microstructure of different ferrous and non-ferrous samples.
2. Explore the effect of heat treatment on various engineering materials by analysing its microstructure and hardness.

List of Practical

1	Preparation of models/charts related to atomic/crystal structure of metals.
2	Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel. 3.3
3	Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4	Practice of specimen preparation (cutting, mounting, polishing, etching) of mild steel, Aluminium and hardened steel specimens.
5	Study of the microstructure of prepared specimens of Mild Steel, Aluminium and hardened steel.
6	Identification of ferrite and pearlite constituents in given specimen of milsteel.
7	Determination of hardenability of steel by Jominy End Quench Test.

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities.
For achieving the above, suggestive list of activities to be conducted are:

Part – A
(Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B
(Outdoor Activities)

3. Sports/NSS/NCC
4. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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ENVIRONMENTAL STUDIES FOR B.TECH CIVIL, ELECTRONICS, ELECTRICAL ENGINEERING, MECHANICAL AND COMPUTER SCIENCE

Sl. No.	Category	Course Code	Course Title	Hours per week			Total contact hrs,	Credits
				Lecture	Tutorial	Practical		
1	Mandatory Non-credit Course	EVS101-18	Environmental Studies	2	0	0	21	0

*** 40 Hours are kept for various activities under the head of activities. There will be a final theory examination for the students of 50 marks but these marks will not be added to their final result as assessment will be satisfactory or non-satisfactory.**

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.
2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.
3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.
4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world

Environmental Studies [L:2; T:0; P:0 (Credits-0)]

1. Environment Science (Mandatory non-credit course)

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students.

Detailed Contents

Module 1 : Natural Resources :Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.

Module 2 : Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem.
Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems:

a. Forest ecosystem
b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3 : Biodiversity and its conservation

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India

Module 4 : Social Issues and the Environment

- From Unsustainable to Sustainable development
- Resettlement and rahabilitation of people; its problems and concerns.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion,

  Nuclear accidents and holocaust. Case Studies.
- Public awareness.

***ACTIVITIES**

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.

Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).

Videography/ photography/ information collections on specialties/unique features of different types of common creatures.

Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

1 *(A) Awareness Activities:*

a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive
i) To live with some eminent environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess
j) To know about the different varieties of plants
k) Shutting down the fans and ACs of the campus for an hour or so
l) Visit to a local area to document environmental assets

   river/forest/grassland/hill/mountain/lake/Estuary/Wetlands

m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
n) Visit to a Wildlife sanctuary, Pushpa Gujral Science City, Kapurthala, National Park or Biosphere Reserve

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)

3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p

4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)

5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p

6. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)

7. Heywood, V.H & Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.

8. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)

9. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)

10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p

11. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
12. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)

13. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)

14. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p.

BTME501-18 HEAT TRANSFER

Course objectives:
To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications
Course Outcomes:

1. To teach students the basic principles of conduction, radiation, and convection heat transfer. Students will demonstrate an understanding of the basic concepts of conduction, radiation, and convection heat transfer.

2. To extend the basic principle of conservation of energy to systems that involve conduction, radiation, and heat transfer. Students will demonstrate an understanding of the concept of conservation of energy and its application to problems involving conduction, radiation, and/or convection heat transfer. This principle will be used to formulate appropriate mathematical models and associated thermal boundary conditions.

3. To train students to identify, formulate, and solve engineering problems involving conduction heat transfer. Students will demonstrate the ability to formulate practical conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.

4. To train students to identify, formulate, and solve engineering problems involving forced convection heat transfer, natural convection heat transfer, and heat exchangers. Students will demonstrate the ability to formulate practical forced and natural conduction heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results. Students will also demonstrate an ability to analyze the performance of heat exchangers

5. To train students to identify, formulate, and solve engineering problems involving radiation heat transfer among black surfaces and among diffuse gray surfaces. Students will demonstrate the ability to formulate practical radiation heat transfer problems by transforming the physical system into a mathematical model, selecting an appropriate solution technique, and evaluating the significance of results.

Detailed Contents:
Unit-1
Introduction to Heat Transfer: Thermodynamics and Heat Transfer. Modes of Heat Transfer: Conduction, convection and radiation. Effect of temperature on thermal conductivity of materials; Introduction to combined heat transfer mechanism.
Conduction: Fourier's law of heat conduction. Coefficient of thermal conductivity. Effect of temperature and pressure on thermal conductivity of solids, liquids and gases. Three-dimensional general conduction equations in rectangular, cylindrical and spherical coordinates.
Steady State one-dimensional Heat conduction-I: Deduction of one-dimensional steady state heat conduction equation in rectangular; cylindrical and spherical coordinates with and without internal heat generation for uniform thermal conductivity of material. Concept of variable thermal conductivity.
Steady State one-dimensional Heat conduction-II: Electrical network analysis for heat transfer through composite/multilayer material. Application of heat conduction with internal heat generation in case of piston crown and in nuclear fuel rod with/ without cladding. Concept of equivalent area. Conduction shape factor. Conduction through edges and corners of walls. Critical thickness of insulation layers on electric wires and pipes carrying hot fluids.
Unit-II
One Dimensional Transient Conduction Heat Transfer: Systems with negligible internal resistance – Significance of Biot and Fourier Numbers –Infinite bodies- Chart solutions of transient conduction systems- Concept of Semi-infinite body.
Theory of Fins: Concept of fin. Classification of fins and their applications. Straight fins of uniform cross-section. Individual and total fin effectiveness and efficiency. Application of fins in temperature measurement of flow through pipes and determination of error in its measurement.
Unit-III
Convection: Classification of systems based on causation of flow, condition of flow, configuration of flow and

medium of flow. Dimensional analysis as a tool for experimental investigation. Buckingham Pi Theorem and method. Application for developing semi-empirical, non- dimensional correlation for convection heat transfer, Significance of non-dimensional numbers. Concepts of continuity, momentum and energy Equations.

Forced convection: External Flows: Concepts about hydrodynamic and thermal boundary layer and use of empirical correlations for convective heat transfer. -Flat plates and Cylinders. Internal Flows: Concepts about Hydrodynamic and Thermal Entry Lengths Division of internal flow based on this Use of empirical relations for Horizontal Pipe Flow and annulus flow.

Natural Convection: Physical mechanism of natural convection. Buoyant force. Empirical heat transfer relations for natural convection over vertical planes and cylinders, horizontal plates and cylinders, and sphere. Combined free and forced convection

Unit-IV

Heat Exchanger: Types of heat exchangers; Fouling factors; Overall heat transfer coefficient; Logarithmic mean temperature difference (LMTD) method; Effectiveness-NTU method; Compact heat exchangers. 3 **Condensation and Boiling** Boiling: Definition and types of boiling. Different regimes and heat transfer during pool boiling of a liquid. Nucleation and different theories accounting for increased heat transfer coefficient during nucleate phase of boiling. Condensation: Definition and types of condensation, film wise condensation on a vertical and inclined surface.

UNIT-V

Thermal Radiation: Process of heat flow due to radiation. Definition of emissivity, absorptivity, reflectivity and transmissivity. Concept of black and grey bodies. Plank's law of non chromatic radiation. Wien's displacement law. Kirchoff's law. Stefan Boltzmann's law. Lambert's Cosine law. Definition of intensity of Radiation, irradiation and radiosity. Geometric/ configuration factor and its use in heat exchange between two black bodies. Electrical network analysis for radiation exchange between two, three or four bodies (e.g. boiler or other furnaces). Simplification of electrical network analysis for its application to simple bodies like two parallel surfaces, concentric cylinders/spheres and a body enveloped by another body. Use of radiation shields.

Text/Reference Books: 1. Incropera F.P. and De Witt D.P., "Fundamentals of Heat and Mass transfer", John Wiley, 7th Edition, 2011.
2. Cengel, A. Yunus, "Heat and Mass Transfer", Tata McGraw Hills Education Private Ltd, 4 th Edition, 2013.
3. Kumar, D.S. "Fundamentals of Heat and Mass Transfer", S K Kataria & Sons, 7th Edition, 2013.
4. Chapman. A. J, "Heat Transfer", McGraw Hill, 7th Edition, 1990.
5. Holman, J.P. "Heat Transfer", Tata McGraw-Hill Publishing Company Ltd, 9th Edition, 2008.

BTME502-18 DESIGN OF MACHINE ELEMENTS

Course objectives:
To provide knowledge of design procedure for simple components like keys, cotters, fasteners, shafts, couplings, pipe joints and levers under static and fatigue loading. Objective of this course is to make the students capable of designing mechanical systems consisting of wide range of machine elements.

Course Outcomes:

After successfully completing this course, the students/learners will be able to:

1. Demonstrate recalling and applying knowledge of Basic Sciences, Graphics & Drawing, Basic Manufacturing Processes and Material Science, for design procedures of various Mechanical components.
2. Comprehend the effect of different stresses and strains under various loading conditions on the mechanical components and identify the mechanism/mode of failure.
3. Examine and solve design problems involving machine elements on the basis of various theories of failure.
4. Synergize forces, moments and strength information to develop ability to analyze, design and/or select machine elements aiming for safety, reliability, and sustainability.

Detailed Contents:

Introduction

Meaning of design with special reference to machine design, general design considerations, concept of tearing, bearing, shearing, crushing, bending and fracture.

Design for Fatigue

Soderberg, Goodman and Gerber design Criteria

Design of shaft

Design of shafts under static and fatigue loadings, Design of solid and hollow shafts for transmission of torque, bending moments and axial forces, Design of shaft for rigidity.

Design of Bearings

Slider: Principle of hydrodynamic lubrication, modes of lubrication, bearing performance parameters, slider bearing design.

Roller: Types, selection guidelines, static and dynamic load carrying capacity, Stribeck's equation, equivalent bearing load, load life relationship.

Design of Transmission Drives

Belt drives: Design of Flat belt, V-belt, Design of the pulley for the same. Chain Drives: Roller chains, polygonal effect, power rating. Selection from the manufacturer's catalogue.

Gear drives: Standard system of gear tooth and gear module, gear tooth failure, strength of gear tooth, terminology of spur, helical, bevel, worm and worm wheel, Design of spur, helical, straight bevel gears, worm and worm wheel.

Design of Springs

Design of springs: helical compression, tension, torsional and leaf springs

Design of clutches and brakes

Design of contact clutches i.e. plate, multi-disc, cone and centrifugal clutches, Design of band, disc, block with shoe and internal expanding brakes.

Design of joints: Threaded fasteners, pre-loaded bolts and welded joints.

Design, Analysis and Applications of Power screws and flexible coupling.

Books

1. Joseph E. Shigley, Charles Russell Mischke, Richard Gordon Budynas, Mechanical Engineering Design, McGraw-Hill
2. Robert L. Norton, Machine Design; An Integrating Approach, Pearson Publication.
3. Robert C. Juvinall Fundamentals of machine component design, JohnWiley Eastern
4. V.K Jadon, Analysis and design of machine elements, I.K. International
5. V.B Bhandari, Design of Machine elements, Tata Mc-Graw. Hill

Note: Design Data book is allowed in Examination.

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BTME503-18 MANUFACTURING PROCESSES

Course objectives:
To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Course Outcomes:
Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for makingdifferent products.

Detailed Contents:

Unit -1 Conventional Manufacturing Processes:
Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses.
Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.
Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, Surface finish and integrity, Machinability, Cutting tool materials, Cutting fluids, Coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining.

Unit II: Additive manufacturing:
Rapid prototyping and rapid tooling

Unit III: Joining/fastening processes:
Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes; Adhesive bonding.

Unit IV Unconventional Machining Processes:
Unconventional Machining Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters.
Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant &maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining

Unit V Tooling
Tooling for conventional and non-conventional machining processes: Mould and die design, Press tools, Cutting tools; Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design.

Text/Reference Books:
1. Rao P N, Manufacturing Technology, Foundry, Forming & Welding, Tata McGraw Hill.
2. Kalpakjian S and Steven R. Schmid, Manufacturing Engineering and Technology, Pearson Publishers.
3. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
4. Degarmo, Black &Kohser, Materials and Processes in Manufacturing
5. Ghosh A, & Mallik A K 1986. Manufacturing science: Ellis Horwood.
6. Campbell J S, Principles of manufacturing materials and processes: Tata McGraw-Hill
7. Shan H S, Manufacturing Processes, Vol. I, Pearson Publishers.
8. Little, Welding and Welding Technology, McGraw-Hill Education (India) Pvt Ltd.
9. NPTEL courses, http://www.nptel.iitm.ac.in/courses.php?disciplineId=112 web and video resources on Manufacturing Processes I

BTME504-18 MANAGEMENT AND ENGINEERING ECONOMICS

Course objectives:

- Acquire knowledge of economics to facilitate the process of economic decision making
- Acquire knowledge on basic management aspects

Course Outcomes:

On completion of this subject students will be able to

6. Explain the development of management and the role it plays at different levels in an organization.
7. Comprehend the process and role of effective planning, organizing and staffing for the development of an organization.
8. Understand the necessity of good leadership, communication and coordination for establishing effective control in an organization.
9. Understand engineering economics demand supply and its importance in economics decision making and problem solving.
10. Calculate present worth, annual worth and IRR for different alternatives in economic decision making.
11. Understand the procedure involved in estimation of cost for a simple component, product costing and depreciation, its methods.

Detailed Contents:

Unit-1: **Management**

Introduction: Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought early management approaches – Modern management approaches.

Planning:

Nature, importance and purpose of planning process Objectives -Types of plans (Meaning Only)
Decision making Importance of planning -steps in planning & planning premises - Hierarchy of plans.

Unit-II: Organizing and Staffing

Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees- Centralization Vs Decentralization of authority and responsibility - Span of control - MBO and MBE (Meaning Only) Nature and importance of staffing: Process of Selection & Recruitment (in brief).

Directing & Controlling:

Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling - Essentials of a sound control system - Methods of establishing control (in brief)

Unit-III: **Introduction**

Engineering and economics, Problem solving and decision making, Laws of demand and supply, Difference between Microeconomics & Macroeconomics, equilibrium between demand & supply, elasticity of demand, price elasticity, income elasticity. Law of Returns, Interest and interest factors, simple and compound interest, Cash flow diagrams, personal loans and EMI payment calculation with flexible interest rates, Discussion and problems

Unit-IV: **Present, future and annual worth and rate of returns**

Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinites lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life, Rate of return, minimum acceptable rate of return, IRR anomalies and misconceptions, Cost of capital, comparisons of all present future and annual worth with IRR, product costing, Discussions and problems

Unit-V: **Costing and Depreciation**

Costing and depreciation:

Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, mensuration and estimation of material cost, cost estimation of mechanical process, idling time. Product costing (approaches to product costing), causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, taxation concepts, personal income taxes and corporate taxes, Discussions and problems.

Text Books:

1. Principles of Management by Tripathy and Reddy
2. Mechanical estimation and costing, T.R. Banga & S.C. Sharma, 17th edition 2015
3. Engineering Economy, Riggs J.L. McGraw Hill, 2002
4. Engineering Economy, Thuesen H.G. PHI , 2002

Reference Books:

1. Management Fundamentals- Concepts, Application, Skill Development - RobersLusier - Thomson
2. Basics of Engineering Economy, Leland Blank & Anthony Tarquin, McGraw Hill Publication (India) Private Limited
3. Engineering Economics, R.Paneerselvam, PHI publication
4. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
5. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
6. Modern Economic Theory, By Dr. K. K. Dewett& M. H. Navalur, S. Chand Publications

BTME505-18 HEAT TRANSFER LAB.

Course objectives:

To provide knowledge about application of conduction, convection and radiation heat transfer concepts to different practical applications

Course Outcomes:

After undergoing this course, students shall be able to:

1. Design and fabricate the experimental setups related to heat transfer phenomena.
2. Measure and analyse different heat transfer parameters.
3. Apply finite difference methods to solve simple heat transfer problems.

A. Two to three students in a group are required to do one or two practicals in the form of Lab. Project in the topic/s related to the subject matter of Heat Transfer and in consultation with teacher. The complete theoretical and experimental analysis of the concerned topic is required to be performed (including design and fabrication of new experimental set up; if required; or modifications/retrofitting in the existing experimental set ups).

B. Each student is required to use Finite Difference Method for analysis of steady state one dimensional and two dimensional conduction problems (Minimum two problems one may be from the Lab. Project) such as conduction through plane/cylindrical/spherical wall with or without internal heat generation; heat transfer through fins; bodies with irregular boundaries subjected to different boundary conditions.

Minimum twelve experiments from the following:

1. Composite Slab Apparatus – Overall heat transfer co-efficient.
2. Heat transfer through lagged pipe.
3. Heat Transfer through a Concentric Sphere
4. Thermal Conductivity of given metal rod.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer in forced convection apparatus.
8. Heat transfer in natural convection
9. Parallel and counter flow heat exchanger.
10. Emissivity apparatus.
11. Stefan Boltzman Apparatus.
12. Critical Heat flux apparatus.
13. Study of heat pipe and its demonstration.
14. Film and Drop wise condensation apparatus

BTME506-18 MANUFACTURING PROCESSES LAB

Course Outcomes:

After studying this course, students shall be able to:

1. Determine/calculate the clay content, moisture content, hardness, permeability and grain fineness number of moulding sand sample.
2. Use oxy-acetylene gas welding, manual arc welding, MIG, TIG and spot-welding processes to make various joints.
3. Use machine tools such as lathe, shaper and milling machine for machining/cutting various profiles on work pieces.
4. Learn about the constructional features and working of grinding machines, hydraulic press, draw bench, rolling mills, drawing and extrusion equipment.

Casting

1. To determine clay content, moisture content, hardness of a moulding sand sample.
2. To determine shatter index of a moulding sand sample.
3. To test tensile, compressive, transverse strength of moulding sand in green condition.
4. To determine permeability and grain fineness number of a moulding sand sample.

Welding

1. To make lap joint, butt joint and T- joints with oxy- acetylene gas welding and manual arc welding processes
2. To study MIG, TIG and Spot-welding equipment and make weld joints by these processes.

Machining and Forming

1. To study constructional features of following machines through drawings/ sketches:
    a. Grinding machines (Surface, Cylindrical)
    b. Hydraulic Press
    c. Draw Bench
    d. Drawing and Extrusion Dies
    e. Rolling Mills
2. To grind single point and multipoint cutting tools
3. To prepare job on Lathe involving specified tolerances; cutting of V- threads and square threads.
4. To prepare job on shaper involving plane surface,
5. Use of milling machines for generation of plane surfaces, spur gears and helical gears; use of end mill cutters.
6. To determine cutting forces with dynamometer for turning, drilling and milling operations.

Note: At least one industrial visit must be arranged for the students for the live demonstration of Casting, Welding, Forming, machining (Conventional and non-conventional) processes.

BTME507-18 NUMERICAL METHOD LAB

Course Objectives

This course provides understanding of implementations of basic numerical methods for solving different problems *viz.* nonlinear equations, system of equations, numerical integration and ordinary differential equations etc. The basic objective of this course is to develop capability of programming of numerical methods in the students so that they can develop and implement their own computer programs of the methods for solving different problems arising in science, engineering and technology etc.

Course Outcomes: After completion of this course, the students will be able to:

- Understand different implementation modes of numerical methods.
- Use the numerical methods with the understanding of limitations of these methods for solving problems.
- Develop and implement their own computer programs.
- Solve problems more accurately and efficiently in low computational time.
- Handle the problems conveniently which are difficult to deal with manually.

.**List of experiments:**

1. Make a program of bisection method for solving algebraic/transcendental equations and implement it on some problems.
2. Develop a program of Newton-Raphson's method for solving algebraic/transcendental equations and implement it on some problems.
3. Develop and implement a program of Method of False Position for solving algebraic/transcendental equations.
4. Develop and implement a program of Gauss-elimination method for solving a system of linear equations.
5. Develop and implement a program of trapezoidal rule to approximate a definite integral.
6. Develop and implement a program of Simpson's rule to approximate a definite integral.
7. Develop and implement a program of Euler's method for solving initial value problems of ordinary differential equations.
8. Develop and implement a program of fourth order Runge-Kutta method for solving initial value problems of ordinary differential equations.
9. Develop and implement a program of two-step Adams-Bashforth method for solving initial value problems of ordinary differential equations.
10. Develop and implement a program of two-step Adams-Moulton method for solving initial value problems of ordinary differential equations.

Note. Use any programming language/computer algebra system to develop and implement the following programs

BTME601-18 REFREGERATION AND AIR CONDITIONING

Course objectives:
To introduce the students, the basic refrigeration cycles of various refrigeration systems. To impart the students with basic understanding of and air conditioning systems for different climatic seasons. To give the basic understanding of design aspects of RAC components such as evaporators, condensers, capillary tubes, expansion valve etc.

Course Outcomes:
After undergoing this course, the student will:

12. Illustrate the fundamental principles and applications of refrigeration and air conditioning system
13. Obtain cooling capacity and coefficient of performance by conducting test on refrigeration systems.
14. Calculate the energy requirements of cooling and heat equipment for air conditioning applications.
15. Explain the properties, applications and environmental issues of different refrigerants.
16. Demonstrate an ability to analysis psychrometric processes and cycles of air conditioning systems.

Detailed Contents:

1. Basic Concepts

Classification of refrigeration systems, Refrigeration effect, cooling capacity, heating effect, heating capacity; Units of refrigeration; Coefficient of performance and Energy Performance Ratio; Single Phase Reversed Carnot cycle and its limitations; Two Phase Reversed Carnot cycle and its limitations.
(4)

2. Vapour Compression Refrigeration Cycles

Modifications of reversed Carnot cycle with vapour as a refrigerant, Vapour compression refrigeration cycle & system; Representation of this cycle on P-V, T-S and P-H diagrams and its analysis using T-S and P-h diagrams and Refrigeration Tables for sub cooled, saturated and superheated refrigerant, volumetric efficiency of compressor; Effect on performance of VCRS due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours; Actual vapour compression refrigeration cycle on T-sand P-h diagrams (no mathematical analysis); Numerical problems. Compound compression with single evaporator, Multi evaporators with single compressor, along with schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, with individual and multiple expansion valves arrangements. (Without numerical problems). (8)

3, **Refrigerants**

Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; comparative study of commonly used refrigerants and their fields of application; Azeotropes; Zeotropes; Effect of moisture and oil miscibility; Antifreeze solution; Leak detection and charging of refrigerants; Environmental aspects of conventional refrigerants; Eco-friendly refrigerants and action plan to reduce ecological hazards.

4. Vapour Compression Refrigeration System Components

Classifications and working of Compressors, Condensers, Expansion devices and Evaporators. Performance characteristics of the condensing unit, Performance characteristics of the compressor-capillary tube. (6)

5. Vapour Absorption Refrigeration Cycle

Principle of vapour absorption refrigeration; basic components of the vapour absorption refrigeration system; Desirable properties of absorption system refrigerant and absorbent; Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system; Electrolux refrigeration system; comparison between vapour absorption and compression systems (no mathematical analysis).
(4)

6. Psychrometry

Dry Air; Moist Air; Basic laws obeyed by Dry Air and Moist Air; Psychometric properties of air: Dry bulb, wet bulb and dew point temperatures, Relative and specific humidity, degree of saturation adiabatic saturation temperature, enthalpy of air and water vapours; Psychometric chart and its use; Numerical problems. Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning. (5)

7. Psychometric Processes

Basic psychometric processes; Adiabatic mixing of two air streams Sensible heating; Sensible cooling; cooling with dehumidification; cooling with humidification; Heating with dehumidification; Heating with humidification; By-pass factor; Contact factor; Sensible heat factor; Room sensible heat factor; Grand sensible heat factor. (5)

8. Air conditioning Load Calculations

Sources of heat load; sensible and latent heat load; Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises.

(4)

Text/Reference Books:

1. C.P. Arora, Refrigeration and Conditioning, Tata McGraw Hill
2. Manohar Prasad, Refrigeration and Conditioning, Wiley Eastern Limited
3. Jordan and Priester, Refrigeration and Conditioning, Prentice Hall of India
4. W.F. Stoecker, Refrigeration and Conditioning, McGraw Hill

BTME602-18 MECHANICAL MEASURMENT AND METROLOGY

Course objectives:

1. To provide a knowledge about measurement systems and their components
2. To learn about various sensors and transducers used for measurement of mechanical quantities
3. To learn about usage of various measuring instruments
4. To learn metrology of screw, gear and surface texture

Course outcomes:

After undergoing this course, the student will be able to:

1. Interpret characteristics of measuring instruments.
2. Describe various industrial metrological instruments for measuring linear, angular, screw thread and gear profiles.
3. Apply the fundamental principles for measurement of various mechanical quantities like Force/torque etc.
4. Develop an ability of problem solving and decision making by identifying and analyzing the cause for variation and recommend suitable corrective actions for quality measurements.

Detailed Contents:

MECHANICAL MEASUREMENT SYSTEMS: (04)

Need of mechanical measurement, basic and auxiliary functional elements of a measurement system Basic definitions: Hysteresis, Sensitivity, Linearity, Resolution, Threshold, Drift, Zero stability, loading effect and system response. Dead Time and dead zone, Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification.

SENSORS AND TRANSDUCERS: (05)

Introduction to sensors and transducers, types of sensors, review of electro-mechanical sensors and transducers - variable resistance, inductance and capacitive pickups, photo cells and piezoelectric transducers, Introduction to signal processing and conditioning.

LINEAR AND ANGULAR MEASUREMENTS: (04)

Vernier calliper, Micrometer, Interval measurements: Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges.

MEASUREMENT OF FORCE, TORQUE AND STRAIN: (06)

Load cells, cantilever beams, proving rings, differential transformers.

Torsion bar dynamometer, Servo controlled dynamometer, Absorption dynamometers. Power Measurements.

Mechanical strain gauges, Electrical strain gauges, strain gauge material, gauge factors, theory of strain gauges, bridge arrangement, temperature compensation.

DISPLACEMENT, VELOCITY/SPEED AND ACCELERATION MEASUREMENT: (05)

Working principal of Resistive Potentiometer, Linear variable differential transducers (LVDT), Electro- Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer,

TEMPERATURE MEASUREMENT: (05)

Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices.

METROLOGY: (02)

Basics of Metrology, Line end and wavelength standards, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.

METROLOGY OF GEARS AND SCREW THREADS: (06)

Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth Vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears.

Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges.

METROLOGY OF SURFACE FINISH: (06)

Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off, other methods for measuring surface roughness: Light Interference microscopes, Mecrin Instruments

COMPARATORS: (04)

Functional Requirements, Classification, Mechanical Comparators, Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators.

MISCELLANEOUS METROLOGY: (04)

Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements,

Suggested Books:

1. E.O Doebelin, Measurement System: Application and Design, McGraw Hill

2. J.P Holman, Experimental Methods for Engineers, McGraw Hill

3. D.S Kumar, Mechanical Measurement and Control, Metropolitan Book Co.

4. R.K Jain, Engineering Metrology, Khanna Publishers

5. B.C Kuo, Automatic Control systems, Prentice Hall

BTME603-18 AUTOMOBILE ENGINEERING

Course objectives:

- To understand the construction and working principle of various parts of an automobile.
- To have the practice for assembling and dismantling of engine parts and transmission system

Course Outcomes:

After undergoing this course the student will be able to:

1. Identify the different parts of the automobile.
2. Explain the working of various parts like engine, transmission, clutch, brakes, steering and the suspension systems.
3. Develop a strong base for understanding vehicle safety systems and future developments in the automobile industry.

Detailed Contents:

1, Introduction: Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit.

2. Power Unit: Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system., turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

3. Fuel Supply System: Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of fuel injection systems (MPFI) used in Indian make vehicles. Diesel fuel system (IDI, DI & CRDI) - cleaning, injection pump, injector and nozzles. Introduction to Gasoline Direct Injection and duel fuel supply systems.

4. Lubrication and Cooling Systems: Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

5. Chassis and Suspension: Loads on the frame, considerations of strength and stiffness, engine mounting, conventional and independent suspension systems; adaptive suspension systems; shock absorbs and stablizers; wheels and tyres.

6. Transmission system: Basic requirements and components of transmission systems; constructional features of automobile clutch, gear boxes & types, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission. Types of automatic transmissions (Torque convertor AT, AMT, CVT, DCT/DSG). Traction control system.

7. Steering System: Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel balancing & alignment; power steering (electrical and hydraulic).

8. Braking System: General braking requirements; Weight transfer during braking and stopping distances; Mechanical, hydraulic, vacuum power and servo brakes; Adaptive cruise control and braking system

9. Electric System: Conventional (coil and magneto) and transistorized ignition systems; Charging, capacity ratings and battery testing; starter motor and drive arrangements: voltage and current regulation

10. Vehicle safety systems: Active and passive safety systems in an automobile. Air bags, collapsible steering system, seat belts, side impact rods, crumple zones etc. ABS & EBD, ESP, diver alert system.

11. Alternative Energy Sources : Concept and types of electric & Hybrid Vehicles . Fuel cell technology, Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance,

12. Maintenance: Preventive maintenance, trouble shooting and rectification in different systems; engine turning and servicing

Text/Reference Books:

10. W.H Crouse, Automotive mechanics, McGraw Hill

11. J. Heitner, Automotive Mechanics, East West Press

12. Kirpal Singh, Automobile Engineering Vol. I and II, Standard Publishers

13. J. Webster, Auto Mechanics, Glencoe Publishing Co.

14. P.S Gill, Automobile Engineering, S.K Kataria

BTME604-18 INTRODUCTION TO INDUSTRIAL MANAGEMENT

Course objectives:

- To help the students gain understanding of the functions and responsibilities of industrial managements.
- To enable them to analyze and understand the environment of the organization.
- To help the students to develop cognizance of the importance of management principles.
- To provide them tools and techniques to be used in the performance of the managerial job.

Course Outcomes:

- Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities.
- Demonstrate the roles, skills and functions of management.
- Understand the concepts related to industrial management.

Detailed Contents:

Unit-1: Concept of industrial engineering, Roles of industrial engineer, Tools of management science, Introduction to quality, Excellence in manufacturing, Excellence in service, factors of excellence, relevance of total quality management.

Unit-II: Concept of production, Production system, Input output model, definition of quality, Total quality control and Total Quality Management, salient features of total quality control and total quality management, benefits of total quality management.

Unit-III: Introduction to product design, Effect of design on cost, Requirements of a good product design, Factors affect product design, Product life cycle, Need and concept of product planning, Concept of product development. Introduction of industrial cost, Elements of cost, Breakeven analysis.

Unit-IV: Materials management, Purchasing, Objectives of purchasing, Activities, duties and functions of purchasing department, Purchase organizations, Buying techniques, Purchasing procedure.

Unit-V: Concept of plant maintenance, Objectives and importance of plant maintenance, Duties, functions and responsibilities of plant maintenance department, Organization of maintenance, Scheduled, preventive and predictive maintenance.

Unit-VI: Inventory, Inventory control, Objectives of inventory control, ABC analysis, Just-in-time (JIT), Definition: Elements, benefits, equipment layout for JIT system, Waste elimination, workers involvement through JIT: JIT cause and effect chain, JIT implementation.

Unit-VII: Benchmarking: Meaning of benchmarking and its concept, Definition of benchmarking, Benefits of bench marking, process and types of benchmarking.

Unit-VIII: Customer: Types of customers, Customer satisfaction, Role of marketing, Data collection, Customer complaints, Redressal mechanism.

Text Books:

1. Industrial Engineering and Management/ O. P. Khanna/ Dhanpat Rai and Sons
2. General and Industrial Management/ H Fayol/ Pitman
3. Industrial Management/ I. K. Chopde and A. M. Sheikh/ S. Chand
4. A Text Book of Industrial Management/ A. P. Verma and N. Mohan/ Katson
5. Total Quality Management/ Jeol E. Ross/ Taylor and Francis Limited.

BTME605-18 REFREGERATION AND AIR CONDIITONING LAB

Course Outcomes:

1. Conduct and analyze the experimental data of performance of vapour compression refrigeration system in domestic refrigerator and water cooler.
2. Conduct and analyze the experimental data of performance of Electrolux Refrigerator.
3. Conduct the performance of window type room air conditioner and system.
4. Analyze the industrial set up for the working and use of vapour compression refrigeration system in cold storage.

Course Objectives:

To introduce the students for hand on practice to perform the experiment and evaluate the experimental record pertaining to refrigeration cycles of various refrigeration systems. To impart the students with training of interfacing the theoretical and practical skills. Refrigeration and Air Conditioning and its primary components such as evaporators, condensers, capillary tubes, expansion valve etc.

List of Experiments

1. Demonstration of various elements of a vapour compression refrigeration system through refrigeration trainer.
2. Performance testing of domestic refrigerator using refrigeration test rig.
3. Performance testing of Electrolux refrigerator.
4. Study of an Ice plant.
5. Calculation/ Estimation of cooling load for a large building.
6. Visit to a central air conditioning plant for the of study air-conditioning system.
7. Visit to a cold storage for study of its working.
8. Performance testing of window type room air conditioner.
9. Performance testing of water cooler.

BTME606-18 MECHANICAL MEASUREMENT AND METROLOGY LAB

The student will be able to:

1. Demonstrate the use of instruments for measuring linear (internal and external), angular dimensions and surface roughness.
2. Identify proper measuring instrument and know requirement of calibration, errors in measurement etc.
3. Apply analytical and experimental methods to make measurements and to find and correct defects in measurement systems.

.**List of experiments:**

1. Vernier Calliper/ vernier height gauge: Principle of vernier scale to measure internal and external dimensions including depth
2. Micrometer and vernier micrometer: concept, principle and use
3. Sine bar and slip gauges and angle gauge: principle and applications
4. Surface texture: Roughness of machined and un-machined plane and spherical surfaces
5. Profile projector: to measure screw and gear elements
6. Three wire method: Diameter of external V-threads
7. Tool makers microscope: to measure screw and gear elements
8. Dead weight gauge: calibration of pressure gauges
9. Stroboscope: measure speed of rotating elements
10. Thermocouple: principle, applications and preparation

BTME607-18 AUTOMOBILE ENGINEERING LAB

The student will be able to:

1. Identify Construction, working, preventive maintenance, trouble shooting and diagnosis of various Automobile Systems.
2. Understand importance and features of different systems like axle, differential, brakes, steering, suspension, and balancing etc.
3. Identify Modern technology and safety measures used in Automotive Vehicles

List of Experiments

1. Valve refacing and valve seat grinding and checking for leakage of valves
2. Trouble shooting in cooling system of an automotive vehicle
3. Trouble shooting in the ignition system, setting of contact breaker points and spark plug gap
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7. Replacing of ring and studying the method of replacing piston after repair.
8. Dismantling and assembling of diesel and petrol engine.
9. Study of cut section model of Petrol and diesel engine.

BTME609-18 INTERNAL COMBUSTION ENGINES

Course Outcomes:

Students who have done this course will have

1. Knowledge about the basics of IC engines
2. Ability to evaluate operational characteristics of IC Engines
3. Ability to ascertain the effects of fuel/supply systems on emission from an engine.
4. Ability to test engine performance

Detailed Contents:

1. Introduction to IC Engines:

Definition of engine; Heat Engine, Historical Development of IC Engines, Classification & Nomenclature, Application of IC Engines, Air Standard Cycle, Carnot Cycle, Sterling Cycle, Ericson Cycle, Otto Cycle, Diesel cycle, Dual Cycle, Thermodynamics Analysis of these cycles.

2. Actual Working of I.C. Engine:

Working of 4 stroke petrol & diesel engines and their valve timing diagram, working of 2-stroke petrol & diesel engines & their valve timing diagrams, comparison of two stroke & four stroke engines, Actual working of 2 & 4 stroke gas engines and their valve diagram.

3. Fuel Air Cycles and their analysis:

Introduction to fuel air cycles and their significance, composition of cylinder gases, variable specific heats, Dissociation, effect of no. of moles, comparison of air standards & fuel air cycles, effect of operating variable like compression ratio, fuel air ratio, actual cycles and their analysis; Difference between Actual and Fuel-Air Cycle, Actual and Fuel-Air Cycles for S.I. and C.I. Engines.

4. Fuel Supply System:

Fuel Supply System and fuel pumps, properties of air fuel mixture, a sample carburetor an its working, approximate analysis of simple carburetor, Actual air fuel ratio of single jet carburetor, Exact analysis of single jet carburetor, ideal requirements from a carburetor, limitations of single jet carburetor, different devices used to meet the requirements of an ideal carburetor. modern carburetors.

5. Fuel Injection Systems:

Requirement of an Injection system, Classification of Mechanical injection systems, Fuel Feed pump, injection pump, injection pump Governor, mechanical governor, Fuel Injector, Nozzle, Injection of S.I. Engines. Electronic fuel injection system, MPFI system, Electronic Control system, injection timings and modern injection systems.

6. Combustion in S.I. and C.I Engines:

Introduction, Stages of Combination in S.I. Engine, Flame font propagation, factor influencing the flame speed, ignition lag and factors affecting the lag, Abnormal combustion and knocking, control and measurement of knock, effect of engine variables on knocking, rating of S.I. Engine fuels and anti-knock agents, combustion chambers of S.I. Engines. Stages of Combination in C.I. Engine, factors affecting delay period, phenomenon of knock in C.I. Engines, comparison of Knocking in S.I and C.I. engines, combustion chambers for C.I. Engines.

7. Supercharging:

Introduction, purpose of supercharging, type of superchargers, analysis of superchargers, performance of superchargers, Arrangement of Supercharger and its installation, Turbo charged engines, supercharging of S.I. & C.I. Engines. Limitations of supercharging.

8. Engine Emissions and Control
Introduction, Ambient pollution due to engines, emission norms, engine emissions, hydrocarbons and hydrocarbon emissions, CO emission, Oxides of Nitrogen, particulates, other emissions. Emission control methods, catalytic convertors, particulate traps. Methods to control/reduce harmful emissions.

9. Measurement and Testing:
Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps.

Text/Reference Books:

1. V. Ganesan, Internal Combustion Engines, Prentice Hall.
2. V. M. Damundwar, A Course in Internal Combustion Engines, Dhanpat Rai.
3. John B. Heywood, Internal combustion engine fundamentals McGraw-Hill,
4. Colin R. Ferguson, Allan Thomson, Kirkpatrick Internal combustion engines: applied thermo sciences, John Wiley & Sons
5. Richard Stone, Introduction to Internal Combustion Engines Society of Automotive Engineers.
6. Mathur and Sharma, A course in Internal Combustion Engines, Dhanpat Rai.

BTME610-18 Mechatronics System

After successfully completing this course the students will be able to

CO1: Design mux, demux, flip-flops, and shift registers.

CO2: Describe the block diagram, registers, ALU, bus systems, timing & control signals, instruction cycles, and interrupts of 8085 microprocessors.

CO3: Apply the concept of 8085 microprocessor instruction sets and addressing modes in writing assembly language program for a given problem.

CO4: Describe the interfacing of memory, 8255 PPI, ADC, DAC, 7-segment LED system, stepper motor, 8251 and 8253 ICs with 8085 microprocessor

Introduction: Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modeling, Analysis and Simulation, Man-Machine Interface;

Sensors and transducers: classification, Development in Transducer technology, Optoelectronics-Shaft encoders, CD Sensors, Vision System, etc.;

Drives and Actuators: Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control;

Embedded Systems: Hardware Structure, Software Design and Communication, Microprocessors and microcontrollers: Microprocessor systems, Microcontrollers, Applications, programmable logic controller, Basic PLC structure, input and output units, Programmable Logic Devices, Input/output processing, Ladder programming,

Smart materials: Shape Memory Alloy, Piezoelectric and Magneto strictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc.; Micro mechatronic systems: Microsensors,

Mechatronic systems: Mechatronic designs, Case studies.

Course Outcomes: Upon completion of this course, students will get an overview of mechatronics applications and the use of micro-sensors and microprocessors.

Text Books:

1) Mechatronics System Design, Devdas Shetty & Richard A. Kolk, PWS Publishing Company (Thomson Learning Inc.)
2) Mechatronics: A Multidisciplinary Approach, William Bolton, Pearson Education
3) A Textbook of Mechatronics, R.K. Rajput, S. Chand & Company Private Limited
4) Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Prentice Hall

BTME611-18 MICROPROCESSOR IN AUTOMATION

Course objectives:
To introduce the basic concepts of Digital circuits, Microprocessor system and digital controller

Course outcomes:
Students who have done this course will have a good idea of the use of microprocessors for automation

Detailed Contents:

Unit I: Number Systems, codes: BCD, Excess 3, digital electronics: Logic Gates, combinational circuits design: Mux, Demux, Sequential logic circuits design: Flip-flops, Shift registers.

Unit II: Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals. Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

Unit III: Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255).

Unit IV: Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253)

Text/Reference Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, Tata McGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition, 2007).
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall

BTME612-18 COMPOSITE MATERIALS

Course outcomes:

Students who have studied this course will have

1. Understanding about the concept, need and applications of composite materials.
2. Ability to suggest/select optimum combination of Matrix/Reinforcement for various engineering applications.
3. Ability to analyze the effects of influencing factors on the strength of composite materials.

Detailed Contents:

1 Introduction

Introduction to the concept of composite materials, need of composite materials, various engineering applications of composite materials.

2 Reinforcements

Introduction to types of reinforcements, Flexibility, Fiber Spinning Processes, Stretching and Orientation, Glass Fibers, Fabrication, Structure, Properties and Applications, Boron Fibers, Fabrication, Structure and Morphology Residual Stresses, Fracture Characteristics, Properties and Applications of Boron Fibers, Carbon Fibers, Processing, structural Changes Occurring During Processing, Properties and Applications, Organic Fibers, Oriented Polyethylene Fibers, Aramid Fibers, Ceramic Fibers, Oxide Fibers, Nonoxide Fibers, Whiskers, Other Nonoxide Reinforcements, Silicon Carbide in a Particulate Form, Tungsten Carbide Particles, Effect of High-Temperature Exposure on the Strength of Ceramic Fibers, Comparison of different types of Fibers.

3 Matrix Materials

Polymers, Glass Transition Temperature, Thermoplastics and Thermosets, Copolymers, Molecular Weight, Degree of Crystallinity, Stress–Strain Behavior, Thermal Expansion, Fire Resistance or Flammability, Common Polymeric Matrix Materials, Metals: Structure, Conventional Strengthening Methods, Properties of Metals, Need of Reinforcements. Ceramic Matrix Materials: Bonding and Structure, Effect of Flaws on Strength, Common Ceramic Matrix Materials

4 Interfaces

Wettability, Effect of Surface Roughness, Crystallographic Nature of Interface, Interactions at the Interface, Types of Bonding at the Interface, Mechanical Bonding, Physical Bonding, Chemical Bonding, Optimum Interfacial Bond Strength, Very Weak Interface or Fiber Bundle, Very Strong Interface, Optimum Interfacial Bond Strength, Tests for Measuring Interfacial Strength, Flexural Tests, Single Fiber Pullout Tests, Curved Neck Specimen Test, Instrumented Indentation Tests, Fragmentation Test, Laser Spallation Technique.

5 Polymer Matrix Composites

Processing of PMCs, Processing of Thermoset Matrix Composites, Thermoplastic Matrix Composites, Sheet Molding Compound, Carbon Fiber Reinforced Polymer Composites, Interface in PMCs, Glass Fiber/Polymer, Carbon Fiber/Polymer Interface, Polyethylene Fiber/Polymer Interface, Structure and Properties of PMCs, Structural Defects in PMCs, Mechanical Properties, Applications, Pressure Vessels, Recycling of PMCs.

6 Metal Matrix Composites

Types of Metal Matrix Composites, Important Metallic Matrices, Aluminum Alloys, Titanium Alloys, Magnesium Alloys, Copper, Intermetallic Compounds, Processing, Liquid-State Processes, Solid State Processes, In Situ Processes, Interfaces in Metal Matrix Composites, Major Discontinuities at Interfaces in MMCs, Interfacial Bonding in Metal Matrix Composites, Properties, Modulus, Strength, Thermal Characteristics, High Temperature Properties, Creep, and Fatigue, Applications, Electronic-Grade MMCs, Recycling of Metal Matrix Composites.

7 Ceramic Matrix Composites

Processing of CMCs, Cold Pressing and Sintering, Hot Pressing, Reaction Bonding Processes, Infiltration, Directed Oxidation or the Lanxide™ Process, In Situ Chemical Reaction Techniques, Sol–Gel, Polymer Infiltration and Pyrolysis, Electrophoretic Deposition, Self-Propagating High-Temperature Synthesis, Interface in CMCs, Properties of CMCs, Toughness of CMCs, Crack Deflection at the Interface in a CMC, Thermal Shock Resistance, Applications of CMCs, Cutting Tool Inserts, Ceramic Composite Filters, Other Applications of CMCs

8 Carbon Fiber/Carbon Matrix Composites

Processing of Carbon/Carbon Composites, High Pressure Processing, Oxidation Protection of Carbon/Carbon Composites, Properties of Carbon/Carbon Composites, Thermal Properties, Frictional Properties of the Composites, Ablative Properties, Applications of Carbon/Carbon Composites, Carbon/Carbon Composite Brakes, Other Applications of Carbon/Carbon Composites, Carbon/SiC Brake Disks

9 Multifilamentary Superconducting Composites

The Problem of Flux Pinning, Types of Superconductor, Processing and Structure of Multifilamentary, Superconductors, Niobium–Titanium Alloys, A15 Superconductors, Ceramic Superconductors, Applications, Magnetic Resonance Imaging.

Text Books:
1. K.K. Chawla, (1998), Composite Materials, Springer-Verlag, New York
2. B.T. Astrom, (1997), Manufacturing of Polymer Composites, Chapman & Hall
3. Composite materials by J.N.Reddy

Reference Books:/
1. Stuart M Lee, J. Ian Gray, Miltz, (1989), Reference Book for Composites Technology, CRC press
2. Frank L Matthews and R D Rawlings, (2006), Composite Materials: Engineering and Science, Taylor and Francis.
3. D. Hull and T.W. Clyne, (1996), Introduction to Composite Materials, Cambridge University Press

BTME613-18 COMPUTER AIDED DESIGN

Course outcomes:

The students will be able to

1. Create the different wireframe primitives using parametric representations.
2. Create surface primitives using parametric modeling.
3. Create the different solid primitives using the different representation schemes.
4. Apply geometric transformations on the created wireframe, surface and solid models.

Detailed Contents:

Unit 1: Introduction: Historical Development, Geometric Modeling, Explicit and Implicit Equations, Intrinsic Equations, Parametric Equations, Coordinate Systems.

Unit 2: Curve Design: Fundamental of Curve Design, Parametric Space of a Curve, Blending Functions, Reparametrization, Space Curves, Straight lines, Spline Curves, Bezier Curves, B-Spline Curve, Rational Polynomials, NURBS.

Unit 3: Surface Design: Fundamental of Surface Design, Parametric Space of a Surface, Reparametrization of a Surface patch, Sixteen Point form, Four Curve Form, Plane surface, Cylindrical and Ruled Surfaces, Surface of Revolution, Bezier Surface, B-Spline Surface.

Unit 4: Solid Design: Fundamental of Solid Design, Parametric Space of a Solids, Continuity and Composite Solids, Surfaces and Curves in a Solid.

Unit 5: Solid Modeling: Topology and Geometry, Set Theory, Boolean Operators, Set-membership Classification, Euler operators, Graph Based Models, Boolean Models, Instances and Parameterized Shapes, Cell Decomposition and Spatial Occupancy Enumeration, Sweep Representation, Constructive Solid Geometry, Boundary Representation.

Unit 6: Transformations: Translation, Rotation, Scaling, Symmetry and Reflection, Homogeneous Transformations, Orthographic Projections, Axonometric Projections, Oblique Projections, Perspective Transformation.

Unit 7: Assembly Design: Assembly-Modeling, Analytical Properties, Relational Properties and Intersections, Data Transfer Formats.

Recommended Books:

1. Zeid, I., CAD/CAM, McGraw Hill (2008).
2. Rogers, D. F. and Adams, J. A., Mathematical Elements for Computer Graphics, McGraw Hill (1989).
3. Rogers, D. F., Procedural Elements for Computer Graphics, McGraw Hill (2008).
4. Rooney, J. and Steadman, P., Principles of Computer Aided Design, prentice Hall (1988).
5. Mallineuse, G., Computational Concepts and Methods, Kogan Page Ltd. (1986).]
6. Radhakrishnan, P. and Kothandaraman, C. P., Computer Graphics & Design, Dhanpat Rai Publication (2005).

BTME614-18 PRODUCT DESIGN AND DEVELOPMENT

The student will be able to:

1. Understand desirable design aspects considering various production processes and also understand the economic factors of design.
2. Employ engineering, scientific, and mathematical principles to execute a design from concept to finished product
3. Apply the modern approaches to product design considering concurrent design, quality function deployment and various rapid prototyping methods.
4. Apply innovative process techniques in synthesizing information, problem-solving and critical thinking.

Introduction to Product Design: Design by Evolution and Innovation, Essential factors of product design, Production consumption cycle, Flow and value addition in Production consumption cycle, The Morphology of Design, Primary design phases and flowcharting, Role of Allowances, process capability and tolerances in detailed design and assembly

Product Design and Industry: Product Strategies, Time to Market, Analysis of the Product, Standardization, Simplification and specialization, Basic design considerations, Role of Aesthetics in product design, Functional design practice

Design for Production: Producibility requirements in the design of machine components, Forging design, Pressed component design, Casting design for economical molding, eliminating defects and features to aid handling, Design for machining ease, the role of process Engineer, Ease of location and Clamping, Some additional aspects of production design, Design of powder metallurgical parts

Economic Factors Influencing Design: Product value, Design for safety, reliability and Environmental considerations, Manufacturing operations in relation to design, Economic analysis, profit and competitiveness, break even analysis,

Modern Approaches to product Design: Concurrent Design, Quality Function Deployment (QFD)

Rapid Prototyping: Principle of Rapid Prototyping, Rapid Prototyping Technologies (RPT), RPT in Industrial Design.

Books Recommended

1. Product Design and Development by Kail T Ulrich and Steven D Eppinger
2. Product Design and Development by AK Chitale and Gupta
3. Design of Systems and Devices by Middendorf Marcel Dekker

BTME615-18 NON-CONVENTIONAL ENERGY RESOURCES

Course outcomes:

At the end of the course, the student will be able to:

1. Address smart energy and green infrastructure
2. Build models that simulate sustainable and renewable green technology systems
3. Understand the history, global, environmental and economical impacts of green technology
4. Address nonrenewable energy challenges

Unit I

An introduction to energy sources, Environmental Aspects of Power Generation. Heat Transfer from Solar Energy, Physical principles of conversion of solar radiation into heat utilization, Flat Plate Collectors (FPC), Thermal losses and efficiency of FPC, Practical considerations for flat plate collectors, Applications of FPC – Water heating and drying, Focusing Type Collectors: orientation and sun tracking systems, Types of concentrating collectors – cylindrical parabolic collector, compound parabolic collector, Thermal performance of focusing collectors.

Unit II

Solar energy storage system, Application of solar energy: solar water heating, space heating and cooling, solar photovoltaic, solar cooking, solar distillation & desalination , Solar industrial process heating, Solar power generation. Solar Green Houses, Solar thermo mechanical power, solar refrigeration & air conditioning, Solar ponds.

Unit III

Energy from Biomass: Type of biomass sources, Energy plantation, Methods for obtaining energy from biomass, Biomass conversion technologies-wet and dry processes, Biodigestion, Community/Industrial biogas plants, Factors affecting biodigestion, Design of a biogas plant, Classification, advantages and disadvantages of biogas plants, Problems related to biogas plants, Utilization of biogas. Thermal gasification of biomass, Gasifier- classification, chemistry, advantages, disadvantages and application. Alcohol fuels from biomass: overview, feedstock, methods for alcohol production, Ethanol as an alternative liquid fuel; engine performance with alcohol fuels, biodiesel from biomass.

Unit IV

Wind Energy: Basic principles of wind energy conversion: power in the wind, maximum power, forces on the blades, lift and drag, Components of wind energy conversion systems (WEC), Classification, advantages and disadvantages of WEC systems, Types of wind machines, Performance of wind machines, Design considerations, Energy storage, Application of wind energy, Environmental aspect. Tidal Energy. Components of tidal power plants, Single and double basin arrangements, Estimation of energy and power, Advantages and limitations of tidal power. Wave energy- its advantages and disadvantages, energy and power from wave energy.

Unit V

Chemical Energy Sources: Fuel cells: Design, principle, classification, types, advantages and disadvantages, Work output and EMF of fuel cells, Application of fuel cells, Hydrogen energy, Properties of hydrogen, Methods of hydrogen production, Storage and transportation of hydrogen, Advantages and application.

Text Books:

1. G D Rai, 'Non-Conventional Energy Sources', Khanna Publishers. Delhi, 2010
2. S P Sukhatme, 'Solar Energy-Principles of Thermal Collection & Storage', Tata McGraw Hill Publishing Company Ltd., New Delhi

Reference Books

1. John A Duffie & William A Beckman, 'Solar Energy Thermal processes', Wiley Interscience publication .
2. P Garg & J Prakash,' Solar Energy - Fundamentals and Applications', Wiley Interscience publication. 3. Jay Cheng, 'Biomass to Renewable Energy Processes', 1st Edition, CRC press, 2009.

BTME616-18 OPERATION RESEARCH

Course objectives:
The course is designed to understand the mathematical, engineering and modeling skills that may be useful for designing and solving complex industrial/social/economic problems using various optimization models like deterministic and probabilistic models, simulations, queuing theory, inventory model, replacements models and network models, etc.

Course outcomes:

1. Explain various mathematical deterministic operation research models.
2. Describe the problems of probabilistic and simulation models.
3. Demonstrate the queuing, inventory and replacement models etc.
4. Formulate and analyze the network models.

Detailed Contents:

1. Introduction

Origin of OR and its role in solving industrial problems: General approach for solving OR problems. Classification of mathematical models: various decision making environments. (2)

2. Deterministic Models

Formulation of deterministic linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two phase method, Introduction to duality theory and sensitivity analysis: transportation, assignment and sequencing models; Introduction to goal programming; Solution techniques of linear goal programming problems. (6)

3. Probabilistic Models

Decision making under uncertainty: Maximum and minimum models; Introduction to decision tree. Game theory: Solution of simple two person zero-sum games: Examples of simple competitive situation. (4)

4. Simulation

Concept general approach and application. Use of Monte-Carlo simulation technique to queuing and inventory problems. (3)

5. Dynamic Programming

Introduction to deterministic and probabilistic dynamic programming. Solution of simple problems. (3)

6. Queuing Theory

Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations. (4)

7. Replacement Models

Replacement of items that deteriorate, Replacement of items whose maintenance and repair costs increase with time, replacement of items that fail suddenly; replacement of items whose maintenance costs increase with time and value of money also changes, individual replacement policy, group replacement policy. (4)

8. Inventory Models

Inventory models: Classification of inventory control models: Inventory models with deterministic demand, inventory models with probabilistic demand, inventory models with price breaks. (4)

9. Network Models

Shortest route and traveling sales - man problems, PERT & CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction, resource leveling and smoothening. (6)

Text/Reference Books:

1. Principles of Operations Research HM Wagner, Prentice Hall.
2. Operations Research PK Gupta and DS Hira, S. Chand & Co.
3. Introduction to Operation Research Taha
4. Introduction to Operation Research F.S. Hiller and G.I. Libermann, Holden Ray.

BTME617-18 MAINTENACE & RELIABILITY

Course objectives:

This course is designed to introduce basic concepts of maintenance and reliability to the students, to introduce various method of reliability analysis with real time problems with constraints and to make understanding the applications of Reliability and maintenance analysis for different types of systems.

Course outcomes:

1. Understand the concepts of reliability and maintainability
2. The students will be able to use statistical tools to characterise the reliability of an item and determine the reliability of a system, and will also understand the application of maintenance strategies in a manufacturing environment;
3. The students will develop ability in formulating suitable maintenance strategies to enhance system reliability of a manufacturing system

Detailed Contents:

1. Introduction:
Objective and characteristics of maintenance function, Organization of the maintenance system, Operating practices in maintenance, Maintenance record keeping.

2. Cost Aspect of Maintenance:
Costs of machine breakdown, estimation of life cycle costs, Application of work measurement in maintenance, Manpower planning and training, Incentive payments for maintenance.

3. Planning of Maintenance Activities:
Evaluation of alternative maintenance policies breakdown, preventive and predictive maintenance, fault diagnosis and condition monitoring techniques, simulation of alternative practices, Development of preventive maintenance schedule, House keeping practices, total productive maintenance.

4. Maintenance Engineering:
Maintenance requirements of mechanical, electrical, process and service equipment, Safety aspect in maintenance, Aspect of lubrication; chemical control of corrosion, Computerized maintenance information systems.

5. Reliability:
Concept and definition, configuration of failure data, various terms used in failure data analysis in mathematical forms, component and system failures, uses of reliability concepts in design and maintenance of different system.

6. Reliability and Availability of Engineering systems:
Quantitative estimation of reliability of parts, Reliability of parallel and series elements, Accuracy and confidence of reliability estimation, Statistical estimation of reliability indices, Machine failure pattern, Breakdown time distribution.

7. Reliability improvement:
Reliability in design, reliability in engineering, systems, systems with spares, reliability simulation, redundant and stand by systems, confidence levels, component improvement element, unit and standby redundancy optimization and reliability-cost trade off.

8. Fault Tree Analysis:

Introduction and importance, fault tree construction, reliability calculations from fault tree, tie set and cut set methods, event tree and numerical problems.

Suggested Books:

1. Lindley R. Higgins, Maintenance Engineering Handbook, McGraw Hill.
2. R.H. Clifton, Principles of Planned Maintenance, Edward Arnold.
3. A Kelly, Maintenance Planning control, McGraw Hill.
4. L.S Srinath, Reliability Engineering, East West Press.
5. S.K. Sinha, Reliability Engineering, John Wiley.

MECHANICAL VIBRATIONS
(BTME701-18)

Course Outcomes

After completion of this course, the students will be able to
CO1: Formulate mathematical models of problems in vibrations using Newton's second law or energy principles
CO2: Understand the need and measurement of vibration in mechanical systems
CO3: Calculate principal modes of vibration
CO4: Explore the suitable methods of vibration reduction and absorption
CO5: Ability to determine vibratory responses of SDOF and MDOF systems
CO6: Create the mathematical model of a vibratory system to determine its response

UNIT - I Introduction, Classification of Vibration Systems, Harmonic motion, Vector representation of harmonic motion, Natural frequency & response, Effects of vibration, superposition of simple harmonic motions, beats, Fourier analysis-analytical and numerical methods. Single Degree Freedom System, Equation of motion, Newton's method, D'Alembert's principle, Energy method etc., Free vibration, Natural frequency, Equivalent systems, Displacement, Velocity and acceleration, Response to an initial disturbance, Torsional vibrations, Damped vibrations, Vibrations of systems with viscous damping, Logarithmic decrement, Energy dissipation in viscous damping.
UNIT - II Single Degree Freedom: Forced Vibration Forced vibration, Harmonic excitation with viscous damping, steady state vibrations, forced vibrations with rotating and reciprocating unbalance, support excitation, Vibration isolation, Transmissibility, Vibration measuring instruments, Displacement, velocity and acceleration measuring instruments.
UNIT- III Two Degree Freedom systems Introduction, Principal modes, Double pendulum, Torsional system with damping, Coupled system, Principle of vibration absorber, Undamped dynamic vibration absorbers, Torsional vibration absorber, Centrifugal pendulum absorbers, Vibration isolators and Dampers.
UNIT- IV Multi-degree Freedom system: Exact Analysis, Undamped free and forced vibrations of multi-degree freedom systems, influence coefficients, Reciprocal theorem, Torsional vibration of multi-degree rotor system, Vibration of gear system, Principal coordinates, Continuous systems- Longitudinal vibrations of bars, Torsional vibrations of circular shafts.
UNIT- V Multi Degree Freedom system: Numerical Analysis by Rayleigh's method, Dunkerely's, Holzer's and Stodola methods, Rayleigh-Ritz method 5 Critical speed of shafts, Whirling of uniform shaft, Shaft with one disc with and without damping, Multi-disc shafts, Secondary critical speed.
Books and References:
1. Mechanical Vibrations – G. K. Groover, Jain Brothers, Roorkee.
2. Mechanical Vibrations-Theory & Practice, S Bhave, Pearson Education.
3. Mechanical Vibrations-N K Grover, PBS Publications.
4. Theory of Vibrations with Applications, Thomson & Dahleh, Pearson Education.
5. Elements of Vibration Analysis, L Meirovitch, McGraw-Hill Education.
6. Mechanical Vibrations – Tse, Morse & Hinkle
7. Mechanical Vibrations – V. Rama Murthy, Narosa Publications 8. Mechanical Vibrations – D. Nag, Wiley

AUTOMATION IN MANUFACTURING (BTME702-18)

Course Outcomes

After completion of this course, the students will be able to
CO1: Students should be able to design and implement automated systems using pneumatics.
CO2: Students should be able to provide hydraulic solutions for designing automated systems.
CO3: Students should be able to design and implement electro-pneumatic/hydraulic solutions for automated systems.
CO4: Students should be able to apply PLC programming and implement it on PLC kits.
CO5: Students should be able to devise Assembly automated systems using feeders, orienteers and escapement devices

Course Objectives: To understand the importance of automation and a thorough knowledge of its various elements such as sensors, pneumatics, hydraulics and CNC.

Introduction:
Importance of automation in the manufacturing industry. Use of mechatronics. Systems required. Rigid and Flexible automation, Computer control of Machine Tools and Machining Centers,

Design of an automated system:
Building blocks of an automated system, working principle and examples, Fabrication or selection of various components of an automated system. Specifications of various elements. Use of design data books and catalogues.

Data Acquisition:
Study of various sensors required in a typical automated system for manufacturing. Construction and principle of operation of sensors, signal conditioning and data acquisition, use of microprocessor or micro controllers. Configurations. Working.

Drives:
Electrical drives – types, selection criteria, construction and operating principle.

Automation Mechanisms:
Ball screws, linear motion bearings, cams, systems controlled by camshafts. Electronic cams, indexing mechanisms, tool magazines, and transfer systems.

Hydraulic and Pneumatic systems:
hydraulic power pack, pumps, valves, designing of hydraulic circuits, configurations, compressors, valves, distribution and conditioning.

CNC technology:
NC and NC part programming, CNC-Adaptive Control, Automated Material handling. Assembly, basic elements, interpolators and programming.

Books

1. Tonshoff, H.K. and I. Inasaki, Sensors in manufacturing,Wiley-VCH, 2001.
2. HMT Ltd. Mechatronics, Tata McGraw-Hill, New Delhi, 1988.
3. Bradley, D. A., Dawson D., Burd, N. C. and Loader A. J.,Mechatronics: Electronics in products and processes, CRC Press, Florida, USA, 2010.

4. Rothbart, H. A., CAM Design Handbook, McGraw-Hill, 2004.• Norton, R. L., Cam Design and Manufacturing Handbook,Industrial press Inc, 2002.
5. Groover, M. P., Automation, Production Systems, and Computer-Integrated Manufacturing, Prentice Hall, 2001.
6. Parr, A. A., Hydraulics and pneumatics, Elsevier, 1999.
7. Smid, P., CNC Programming Handbook, Industrual Press,New York, USA, 2008.
8. Rao, P. N., CAD/CAM Principles and Applications, Tata McGraw Hill, New Delhi, 2010.

Fundamentals of Management for Engineers (BTME703-18)

Course Objectives: -

- To understand the Management Concepts, applications of Concepts in Practical aspects of business and development of Managerial Skills for Engineers.
- To help the students gain understanding of the functions and responsibilities of industrial managements.
- To enable them to analyze and understand the environment of the organization.
- To help the students to develop cognizance of the importance of management principles.
- To provide them tools and techniques to be used in the performance of the managerial job.

Course Outcomes: -

- The students understand the significance of Management in their Profession.
- The various Management Functions like Planning, Organizing, Staffing, Leading, aspects are learnt in this course.
- Understand the complexities associated with management in the organizations and integrate the learning in handling these complexities.
- Demonstrate the roles, skills and functions of management.

UNIT-I

Introduction to Management: Definition, Nature and Scope, Functions of Management, Managerial Roles, Levels of Management, Managerial Skills, Challenges of Management.

UNIT-II

Introduction to Operations Management, Types of Plant Layout, Introduction to Total Quality Management (TQM), Total Quality Management Models, Benefits of TQM, Basics of Six Sigma and Lean Manufacturing.

UNIT-III

Introduction to Marketing, Functions of Marketing, Types of Marketing, Marketing vs. Selling, Marketing Mix, Product Life Cycle, Market Segmentation, Supply Chain Management (SCM).

UNIT-IV

Introduction to Work Analysis, Definition, need and scope of work analysis, Method Study: Objectives, Step-by-step procedure, Charts and diagrams for recording data, Principles of Motion economy, Therbligs, Work Measurement: Definition, Various techniques of work measurement such as Work Sampling, Stop Watch Time Study, Analytical Estimating, Predetermined Motion Time System, Need for operator rating, Methods of rating, Allowances and their types, Standard time

UNIT-V

Introduction to Productivity: Definition, Reasons for low productivity, methods to improve productivity, Value Engineering: Definition, Types of values, concept, phases and applications of value engineering

UNIT-VI

Introduction to Personnel Management, aims and objectives of personnel management, Principles of a good personnel policy, Recruitment and selection of employees, Education and training of employees, Safety engineering.

BOOKS:

6. Industrial Engineering and Management/ O. P. Khanna/ Dhanpat Rai and Sons
7. Management Essentials/ Andrew Dubrin/ Cengage Learning
8. Fundamentals of Management/ Stephen P. Robbins/ Pearson Education
9. General and Industrial Management/ H Fayol/ Pitman
10. Industrial Management/ I. K. Chopde and A. M. Sheikh/ S. Chand
11. A Text Book of Industrial Management/ A. P. Verma and N. Mohan/ Katson

Scheme & Syllabus of

B. Tech Civil Engineering

Batch 2018 onwards

By

Board of Study CIVIL AND ENVIRONMENTAL SCIENCE

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(Affiliated Colleges)

Study scheme

Third Semester										
S. No.	**Category**	**Subject Code**	**Course Title**	**Hours per week**			**Marks**			**Credits**
				L	**T**	**P**	**Int**	**Ext**	**Total**	
1	Professional Core courses	BTCE-301-18	Surveying & Geomatics	3	1	0	40	60	100	4
2	Professional Core courses#	BTCE-302-18	Solid Mechanics#	3	0	0	40	60	100	3
3	Professional Core courses #	BTCE-303-18	Fluid Mechanics#	3	0	0	40	60	100	3
4	Basic Science Course #	BTAM-301-18	Mathematics III # (Transform & Discrete Mathematics)	4	0	0	40	60	100	4
5	Engineering Science Course	BTEC-305-18	Basic Electronics & applications in Civil Engineering	3	0	0	40	60	100	3
6	Humanities and Social Sciences including Management	HSMC-132-18	Civil Engineering-Introduction, Societal & Global Impact	3	0	0	40	60	100	3
7	Professional Core courses	BTCE-306-18	Surveying & Geomatics Lab	0	0	2	30	20	50	1
8	Professional Core courses	BTCE-307-18	Fluid Mechanics Lab	0	0	2	30	20	50	1
9	Professional Core courses	BTCE-308-18	Solid Mechanics Lab	0	0	2	30	20	50	1
10		BMPD-301-18	Mentoring and Professional Development	0	0	2	Satisfactory/ Unsatisfactory			-
11	Pofessional Skill Enhancement	BTCE-332-18	Training – I*	-	-	-	60	40	100	Satisfactory/Un satisfactory
			Total 28	**19**	**1**	**8**	**390**	**460**	**850**	**23**

*** Students have already completed 3 weeks institutional training and field and market survey in Summer vacation which is to be evaluated by viva-voce conducted along End semester exam of Third semester.**

Note : # These are the minimum contact hrs. allocated.

The contact hrs. may be increased by institute as per the need based on the content of subject.

Fourth Semester

S No	Category	Subject Code	Course Title	Hours Per Week			Marks			Credits
				L	T	P	Int	Ext	Total	
1	Professional Core courses	BTCE-401-18	Concrete Technology	3	0	0	40	60	100	3
2	Professional Core courses	BTCE-402-18	Material, Testing & Evaluation	4	0	0	40	60	100	4
3	Professional Core courses	BTCE-403-18	Hydrology & Water Resources	3	1	0	40	60	100	4
4	Professional Core courses	BTCE-404-18	Transportation Engineering	3	1	0	40	60	100	4
5	Professional Core courses	BTCE-405-18	Disaster Preparedness & Planning	3	0	0	40	60	100	3
6	Basic Sciences (Mandatory Courses)	EVS-101-18	Environment Science (Non- credit)	3	0	0	100	-	100	0
7	Professional Core courses	BTCE-406-18	Concrete Testing Lab	0	0	2	30	20	50	1
8	Professional Core courses	BTCE-407-18	Transportation Lab	0	0	2	30	20	50	1
9	Professional Skill Enhancement		Training –II*	0	0	0	-	-	-	-
10		BMPD-401-18	Mentoring and Professional Development	0	0	2	Satisfactory/ Unsatisfactory			-
			Total 26	**18**	**2**	**6**	**310**	**340**	**650**	**20**

* 2 weeks survey camp and 4 weeks industrial/institutional training for which viva will be conducted along End semester examination of Fifth semester.

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Fifth Semester										
S No	**Category**	**Subject Code**	**Course Title**	**Hours Per Week**			**Marks**			**Credits**
				L	**T**	**P**	**Int**	**Ext**	**Total**	
1	Professional Core courses	BTCE-501-18	Engineering Geology	3	0	0	40	60	100	3
2	Professional Core courses	BTCE-502-18	Elements of Earthquake Engineering	3	0	0	40	60	100	3
3	Professional Core courses	BTCE-503-18	Construction Engineering & Management	3	0	0	40	60	100	3
4	Professional Core courses	BTCE-504-18	Environmental Engineering	4	0	0	40	60	100	4
5	Professional Core courses	BTCE-505-18	Structural Engineering	3	1	0	40	60	100	4
6	Professional Core courses #	BTCE-506-18	Geotechnical Engineering#	3	0	0	40	60	100	3
7	Professional Core courses	BTCE-507-18	Geotechnical Lab	0	0	2	30	20	50	1
8	Professional Core courses	BTCE-508-18	Environmental Engineering Lab	0	0	2	30	20	50	1
9	Professional Core courses	BTCE-509-18	Structural Lab	0	0	2	30	20	50	1
10		BMPD-501-18	Mentoring and Professional	0	0	2	Satisfactory/ Unsatisfactory			-
11	Professional Skill Enhancement	BTCE-532-18	Training – II*	-	-	-	60	40	100	Satisfactory/Unsatisfactory
			Total 28	**19**	**1**	**8**	**390**	**460**	**850**	**23**

* Students have already completed 2 weeks survey camp and 4 weeks summer internship in Summer vacation which is to be evaluated by viva-voce conducted along End semester exam of Fifth semester.

Note : # These are the minimum contact hrs. allocated.

<u>The contact hrs. may be increased by institute as per the need based on the content of subject.</u>

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Sixth Semester										
S No	**Category**	Subject Code	**Course Title**	**Hours Per Week**			**Marks**			**Credits**
				L	**T**	**P**	**Int**	**Ext**	**Total**	
1	Professional Core course	BTCE- 601 -18	Engineering Economics, Estimation & Costing	3	1	0	40	60	100	4
2	Professional Elective courses	PECE-602 X-18	Elective –I	3	1	0	40	60	100	4
3	Professional Elective courses	PECE- 603 Y-18	Elective –II	3	1	0	40	60	100	4
4	Professional Elective courses	PECE- 604 Z-18	Elective – III	3	1	0	40	60	100	4
5	Open Elective Courses	OEZZ-XXX1	Open Elective-I	3	0	0	40	60	100	3
6	Open Elective courses	OEZZ-XXX2	Open Elective – II	3	0	0	40	60	100	3
7	Mandatory Courses (Non-credit)	BTMC-101-18	Constitution of India	3	0	0	100	-	100	0
8		BMPD-601-18	Mentoring and Professional Development	0	0	2	Satisfactory/ Unsatisfactory	S/US		S/US
			Total 27	**21**	**4**	**2**	**290**	**360**	**650**	**22**
.										

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Institute/Department to decide regarding sending students for One Semester Training in 7th or 8th Semester.

Seventh Semester/Eighth Semester										
S No	**Category**	**Subject Code**	**Course Title**	**Hours Per Week**			**Marks**			**Credits**
				L	**T**	**P**	**Int**	**Ext**	**Total**	
1	Professional Elective courses	PECE-701X-18	Elective – IV	3	1	0	40	60	100	4
2	Professional Elective courses	PECE-702Y-18	Elective – V	3	1	0	40	60	100	4
3	Open Elective courses	OECE-701-18	Open Elective – III(Metro system and Engg)*	3	0	0	40	60	100	3
4	Professional Elective courses	PECE-703Z-18	Elective – VI	3	1	0	40	60	100	4
5	Professional core course		Project	0	0	8	40	60	100	7
6	Humanities and Social Sciences including Management courses HSMC255	HSMC-255	Professional Practice, Law & Ethics	2	0	0	40	60	100	2
7	Mandatory Courses (Non-credit)	BTMC-701-18	Management- I (Organizational Behavior)	2	0	0	50	-	50	0
			Total 27	**16**	**3**	**8**	**290**	**360**	**650**	**24**

Note * Metro system and Engg is compulsory open elective for Civil Students

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Institute/Department/Student may decide for Industry oriented courses in lieu of One Semester Training in 7th or 8th Semester (Subject to approval from Competent Authority).

Seventh/ Eighth Semester

S No	Category	Subject Code	Course Title	Evaluation Internal		External			Credits
				Institute	Industry		Ext	Total	
1	Training (one semester)	BTCE-801-18	Software Training And Project	100	50		100	250	16
			Industrial training and Project	100	50		100	250	
			Total	**200**	**100**		**200**	**500**	**16**

Or
Students may obtain relevant credits from MOOC/SWAYAM
Or

Seventh/ Eighth semester

S No	Category	Subject Code	Course Title	Hours Per Week			Marks			Credits
				L	T	P	Int	Ext	Total	
1	Professional Core courses	BTCE-802-18	Smart City	3	1	0	40	60	100	4
2	Project		Project	0	0	24	60	40	100	12
3	Mandatory course	BMPD -803-18	Mentoring and Professional Development	0	0	2	Satisfactory/ Unsatisfactory			S/US
			Total 30	**3**	**1**	**26**				**16**

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PROFESSIONAL (or PROGRAM) ELECTIVE (PE) COURSES [CIVIL ENGINEERING]

The Professional Electives are categorized into six different tracks viz. : Geotechnical engineering (PE1), Structural Engineering (PE2) and construction Engg and Management (PE3) to offer in 6^{th} semester and the remaining three tracks i.e Transportation Engineering (PE4), Environmental Engg (PE5) & water Resources (PE6) to offer in 7^{th} semester

The Program Elective Groups/courses have been categorized/developed keeping in mind the employment prospects of the students. The Program design in B.Tech. CE aims at providing domain specific knowledge to a student at UG level in progression. The Program/course design has been carried out jointly by the Academia in close coordination with Industry to provide a leading edge to the students and to prepare them as per the Industry needs

Professional Elective Course Tracks –Civil Engineering [PEC-CE]

Track	Code Number	Professional Core Course	Semester	Credits
Track-I	PECE-602X-18	Geotechnical engineering	6	4
Track-II	PECE-603Y-18	Structural Engineering	6	4
Track-III	PECE-604Z-18	Construction Engg and Management	6	4
Track-IV	PECE-701X-18	Transportation Engineering	7	4
Track-V	PECE-702Y-18	Environmental Engg	7	4
Track-VI	PECE-703Z-18	Water Resources	7	4
Total Credits				**24**

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Basket of Professional Elective for different Tracks

Tracks	**Basket of Professional Electives**					
Track- I	Foundation Engg PECE-602A-18	Ground Improvement Techniques PECE-602B-18	Advanced Soil Mechanics PECE -602C-18	Geosynthetic Engineering PECE -602D -18	Geo-Environ Ment Engineering PECE -602E-18	Rock Mechanics PECE-602F -18
Track -II	Design of concrete structure PECE -603A-18	Design of steel Structures PECE -603B-18	Advanced Structural Analysi PECE -603C-18	Structure Analysis And Design PECE -603D -18	Prestressed structures PECE -603E-18	Bridge Engg PECE -603F -18
Track -III	Construction Equipment and Automation PECE -604A-18	Sustainable Construction methods PECE -604B-18	Repair and rehabilitation of structures PECE -604C-18	Construction Cost Analysis PECE -604D -18	Contracts Management PECE-604E -18	Construction Engineering Materials PECE -604F -18
Track -IV	Pavement and geometric desigr of Highways PECE -701A-18	Airport planning and Design PECE -701B-18	Intelligent Transportation On systems PECE -701C-18	Highway Construction and Management PECE -701D-18	High Speed Rail Engg PECE -701E-18	Traffic Engg And Management PECE -701F -18
Track -V	Environment La and Policy PECE-702A-18	Rural water Supply And onsite Sanitation System PECE-702B-18	Water and air Quality Modelling PECE-702C-18	Solid and Hazardous Waste Management PECE-702D-18	EIA and LCA PECE-702E-18	Sustainable Engg and Technologies PECE-702F -18
Track –VI	Design of Hydraulic structur PECE-703A-18	River Engg. PECE-703B-18	Ground Water PECE-703C-18	Hydraulic Modelling PECE-703D-18	Transients in Closed conduits PECE-703E-18	Urban Hydrology a hydraulics PECE-703F -18

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LIST OF OPEN ELECTIVE COURSES FOR STUDENTS OF OTHER PROGRAMMS

Offered by Civil Engineering Department for Even Semester

S.No.	Course Title	Subject Code	Semester	Hours Per Week			Credits
				L	T	P	
1	Civil Engineering- Introduction, Societal & Global Impact	HSMC- 132-18	Even	3	0	0	3
2	Disaster Preparedness & Planning	BTCE- 405-18	Even	3	0	0	3
3	Remote Sensing & GIS	OECE-609-18	Even	3	0	0	3
4	Construction Engineering & Management	BTCE- 503-18	Even	3	0	0	3
5	Concrete Technology	BTCE-401-18	Even	3	0	0	3

Odd semester List

S.No.	Course Title	Subject Code	Semester	Hours Per Week			Credits
				L	T	P	
1	Metro system and Engg	OECE-701-18	ODD	3	0	0	3
2	Traffic Management	OECE- 702-18	ODD	3	0	0	3
3	Road Safety	OECE-703-18	ODD	3	0	0	3
4	Environmental Impact Assessment	OECE-704-18	ODD	3	0	0	3
5	Construction Materials	OECE-705-18	ODD	3	0	0	3

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3rd Semester Syllabus

B. Tech Civil Engineering

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Third Semester							
S. No.	Category	Code	Course Title	Hoursperweek			Credits
				L	T	P	
1	Professional Core courses	BTCE-301-18	**Surveying &Geomatics**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students to:

1. Understand the concept, various methods and techniques of surveying
2. Compute angles, distances and levels for given area
3. Apply the concept of tachometry survey in difficult and hilly terrain.
4. Select appropriate instruments for data collection and survey purpose
5. Analyze and retrieve the information from remotely sensed data and interpret the data for survey.
6. Understand the concepts related to GIS and GPS and analyze the geographical data.

Content

Unit-I: ***Introduction to Surveying*****:** Principles, Survey stations, Survey lines- ranging, direct &indirect ranging, Bearing and its measurement with prismatic compass, calculation of angles from bearings, Local Attraction Levelling:, Principles of levelling- booking and reducing levels; differential, reciprocal leveling, profile levelling and cross sectioning. Digital and Auto Level, Errors in levelling; contouring: Characteristics, methods, uses; areas and volumes. Setting up the plane table and methods of plane tabling(Radiation and three point problem only).

Unit-II: ***Triangulation and Trilateration*****:** Theodolite survey: Instruments, Measurement of horizontal and vertical angle; Balancing of Traverse, Omitted Measurements, Tachometry: Definition, determination of tachometer constants and reduced level from tachometric observations. Triangulation - network- Signals. Baseline - choices - extension of base lines - corrections - Trigonometric leveling .

Unit-III: ***Curves****:* Elements of simple and compound curves – Method of setting out Transition curve – length of curve – Elements of transition curve.

Photogrammetry Surveying: Introduction, Basic concepts, flight planning; Stereoscopy, photographic mapping-mapping using paper prints, mapping using stereoplotting instruments, mosaics, map substitutes.

Unit-IV: ***Modern Field Survey Systems***: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, LADAR (drone and vehicle based)

Remote Sensing: Introduction – Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors.

Refernces & Books

1. Duggal, S.K., Surveying Vol I & II, Tata McGraw Hill
2. Punmia, B.C., Jain, Ashok Kumar and Jain, Arun Kumar, Surveying Vol. I, II & III, Laxmi Publications
3. Agor, R., Surveying, Khanna Publishers
4. Bhavikatti, S.S. Surveying & Levelling Volume I & II

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Third Semester							
S. No.	Category	Code	Course Title	Hoursperweek			Credits
				L	T	P	
2	Professional Core courses#	BTCE-302-18	**Solid Mechanics**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

1. Understand the concept of static equilibrium, deformations, and material constitutive behaviour.
2. Describe the concepts of stress, strain and elastic behaviour of materials including Hooke's law relationships to analyze structural members subjected to tension, compression and torsion.
3. Apply the concept of Mohr's circle in the stress/strain calculations.
4. Develop SFD and BMD for different type of beams subjected to different types of loads
5. Plot elastic curves for beams undergoing displacements under different loadings
6. Understand the behaviour of columns and struts under axial loading.

Content

Unit-I: ***Concept of Equilibrium****:* Loads, supports, reactions, displacements; General equilibrium equations; Equilibrium of a point and a member; Concept of free body diagram; Statical determinacy of a problem.

Stresses and Strains*:* Concept of stress and strain; Type of stresses and strains; Stress-strain diagrams for ductile, brittle materials; Generalized Hooke's law; Concept of working stress and factor of safety; Lateral strain, Poisson's ratio and Volumetric strain; Elastic moduli and relationship between them; Bars of varying section, composite bars, thermal stresses.

Unit-II: ***Principal Stresses and Strains:*** Concept of principal stresses, principal strains and principal planes; use of Mohr circle in computation of stresses and strains; Rectangular block subjected to normal stress along and across two planes, combination of normal and tangential stress also with shear stress.

Shear Force and Bending Moment Diagrams*:* Introduction to the concept of shear force, bending moment and the sign convention; Shear force and bending moment diagrams for cantilever, simply supported and overhang beams subjected to point loads, uniformly distributed loads, uniformly varying loads, moments or their combination, point of contra flexure.

Unit-III: Slope and deflection- Relationship between moment, slope and deflection, Moment area method, Macaulay's method. Use of these methods to calculate slope and deflection for determinant beams..

Bending and Shear Stresses: Assumptions **-** theory of simple bending; Derivation of bending equation; Centroid and section modulus of various cross sectional shapes including rectangular, circular, I, channel, angle etc.; Determination of bending stresses, bending stress distribution across various beam sections; Determination of shear stress, shear stress distribution across various beam sections.

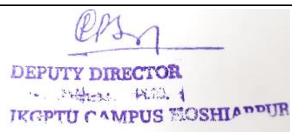
Unit-IV: ***Columns and Struts****:* Stability of Columns; buckling load of axially loaded columns with various end conditions; Euler's and Rankine's formula; Columns under eccentric load, lateral load.

Torsion of Circular Shafts*:* Derivation of torsion equation and its assumptions, application of equation to circular shafts; combined torsion and bending of circular shafts, principal stress and maximum shear stress under combined loading of torsion and bending.

Stresses and strains in thin cylinders: spherical shells subjected to internal pressures; Normal stress, tangential stress.

Text/Reference Books

1. 'Elements of Strength of Materials', Timoshenko, S. and Young, D. H., DVNC, New York, USA.
2. 'Solid Mechanics', Kazmi, S. M. A., TMH, New Delhi.
3. 'Mechanics of Materials', Hibbeler, R. C., Pearson Prentice Hall.
4. 'An Introduction to the Mechanics of Solids', Crandall, S. H., N. C. Dahl, and T. J. Lardner, McGraw Hill.
5. 'Mechanics of Materials', Ferdinand P. Beer, E. Russel Jhonston Jr. and John T. D. Ewolf, TMH.
6. 'Strength of Materials', James M. Gere and Barry J. Goodno, Cengage Learning India Pvt. Ltd., New Delhi.
7. 'Strength of Materials', R. Subramanian, Oxford University Press, New Delhi.



Third Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
3	Professional Core courses #	BTCE-303-18	**Fluid Mechanics**	3	0	0	3

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External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

After completion of the course, student is able to

1. Understand the basic terms used in fluid mechanics and its broad principles
2. Estimate the forces induced on a plane/ submerged bodies
3. Formulate expressions using dimensionless approach and able to determine design parameters by creating replica of prototype at appropriate scale.
4. Apply the continuity, momentum and energy principles and design the pipelines used for water supply or sewage under different situation.
5. Calculate drag force exerted by fluid on the body of varying shapes and able to minimize them.
6. Design and addressing problems in open channel (lined/ unlined) of different shapes and size optimally as per site condition.

Content

Unit-I: *Basic Concepts and Definitions* – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity; variation of viscosity with temperature, Newton law of viscosity; surface tension, capillarity, Bulk modulus of elasticity, compressibility.

***Fluid Statics* -** Fluid Pressure: Pressure at a point, Pascals law, Piezometer, U-Tube Manometer, U-Tube Differential Manometer, Micromanometers, pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Unit-II: *Fluid Kinematics* - Classification of fluid flow : steady and unsteady flow; uniform and non-uniform flow; laminar and turbulent flow; rotational and irrotational flow; compressible and incompressible flow; ideal and real fluid flow; one, two and three dimensional flows; Stream line, path line, streak line and stream tube; stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

***Fluid Dynamics* -** Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation : venturimeter, orifice meter and pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number; Buckingham's π-Theorem.

Unit-III: *Laminar Flow & Turbulent Flow* - Laminar flow through: circular pipes, parallel plates. Stoke's law, Reynolds experiment, Transition from laminar to turbulent flow. Prandtl's mixing length theory, universal velocity distribution equation. Resistance to flow of fluid in smooth and rough pipes, Moody's diagram. Flow through Pipes: Loss of head through pipes, Darcy-Wiesbach equation, minor losses, total energy equation, hydraulic gradient line, Pipes in series, equivalent pipes, pipes in parallel

***Boundary Layer Analysis*-** Assumption and concept of boundary layer theory. Boundary-layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction coefficients. Separation and Control.

Unit-IV: *Open Channel Flow* - Introduction, Comparison between open channel flow and pipe flow, geometrical parameters of a channel, Uniform Characteristics of uniform flow, Chezy's formula, Manning's formula. Most economical section of channel. Specific energy, Specific energy curve, critical flow, discharge curve Specific force Specific depth, and Critical depth. Channel Transitions. Theory of hydraulic jump, Elements and characteristics of hydraulic jump in a rectangular Channel, length and height of jump, location of jump, Types, applications and location of hydraulic jump. Energy dissipation and other uses.

References:

1. Fluid Mechanics & Hydraulic Machines : Dr. R.K. Bansal
2. Hydraulic and Fluid Mechanic by P.N. Modi & S.M. Seth
3. Engineering Fluid Mechanics by R.J. Garde & A.G. Mirajgaoker
4. Fluid Mechanics by Douglas JF, Gasiorek JM, Swaffield JP; Pitman
5. Fluid Mechanics: Streetes VL & Wylie EB;
6. Fluid Mechanics by Potter, Cengage Learning

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Third Semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
4	Basic Science Course	BTAM-301-18	**Mathematics-III (Transform & Discrete Mathematics)**	4	0	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes:

1. Understand the basic results on vector function, their properties and fields so as to apply them for solving problems of engineering.

2. Find length, area and volume using integral calculus that is an important application in engineering.

3. Solve some real problems in engineering using Gauss Divergence and Stokes' theorem

4. To formulate Laplace transform of functions and its applications to solve differential equations that form real life problems in engineering.

5. To formulate Fourier Series, its properties and its applications to solve problems in engineering.

Detailed Content

Section A **(20 lectures)**

Unit I: ***Vector Calculus-I:*** Scalar and Vector point function, Gradient, Directional derivatives, Divergence, Curl and their identities, line, surface, volume integrals and their applications, Solenoidal and Irrotational fields.

Unit II: ***Vector Calculus-II*:** Applications of Green, Gauss and Stokes Theorems, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallelepipeds.

Section B **(20 lectures)**

Unit III: ***Transforms Calculus-I*:**Laplace Transform, Properties of Laplace Transform, Laplace Transform of Unit step function, Impulse function, Dirac-delta function, Periodic functions. Inverse Laplace Transform, convolution theorem, Evaluation of integrals by Laplace Transform, Applications to ODEs and PDEs.

Unit IV :***Transforms Calculus-II*:** Fourier Series, half range Fourier Sine and Cosine series, Fourier integrals, Gibbs Phenomenon, Fourier transforms, Relation between Laplace and Fourier transform, Properties of Fourier Transforms, Convolution Theorem and applications

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
3. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
4. Thomas and Finney, Calculus and Analytic Geometry, 9th Edition, Pearson, 2017.
5. R. K. Jain and S.R.K Iyengar Advanced Engineering Mathematics, 5th Edition, 2017.

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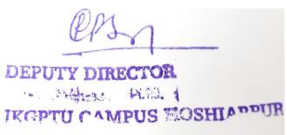

Third Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
5	Engineering Science Course	BTEC- 305-18	**Basic Electronics& applications in Civil Engineering**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Objectives:
The objective of this Course is to provide the students with an introductory and broad treatment of the field of Electronics Engineering to facilitate better understanding of the Devices, Instruments and Sensors used in Civil Engineering applications in subsequent courses.

Course Outcomes:
After undergoing this course students will be able to

1. Understand construction of diodes and their rectifier applications.
2. Appreciate the construction and working bipolar junction transistors and MOSFETs.
3. Design Op-Amp IC based fundamental applications.
4. Comprehend working of basic elements of digital electronics and circuits.

Unit I: **Semiconductor Diodes and Applications** - Semiconductor Diode - Ideal versus Practical, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode – Operation and Applications; Opto-Electronic Devices – LEDs, Photo Diode and Applications;

Unit II: **Transistors & Amplifiers** - Bipolar Junction Transistor (BJT) – Construction, Operation, Common Base, Common Emitter and Common Collector Configurations, Distortion, Operating Point, Voltage Divider Bias Configuration; Introduction to nMOS and pMOS.

Unit III: Operational Amplifiers and Applications - Introduction to Op-Amp, Block Diagram, Pin Configuration of 741 Op-Amp, Characteristics of Ideal Op-Amp, Concept of Virtual Ground, Op-Amp Applications – Adder, Subtractor, Voltage Follower and Comparator; Differentiator and Integrator, Square Wave and Triangular Wave Generation.

Unit IV: Digital Electronics -Boolean Algebra - Binary, Octal, Hexadecimal Number Systems, Addition, Subtraction using 1's and 2's compliment method, Logic Gates – NOT, OR, AND, NOR, NAND, XOR and XNOR Integrated Circuits (ICs); K-Map simplification Truth Tables and Functionality of Flip-Flops – SR, JK and D Flip-Flop.

Text/Reference Books:

1. David. A. Bell (2003), Laboratory Manual for Electronic Devices and Circuits, Prentice Hall, India.
2. SantiramKal (2002), Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India.
3.Thomas L. Floyd and R. P. Jain (2009), Digital Fundamentals by Pearson Education.
4. Paul B. Zbar, A.P. Malvino and M.A. Miller (2009), Basic Electronics – A Text-Lab. Manual, TMH
5. R. T. Paynter (2009), Introductory Electronic Devices & Circuits, Conventional Flow Version, Pearson.

Third Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
6	Humanities and Social Sciences including Management	HSMC-132-18	**Civil Engineering- Introduction, Societal & Global Impact**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

1. Introduction to what constitutes Civil Engineering
2. Understanding the vast interfaces this field has with the society at large
3. Providing inspiration for doing creative and innovative work for the benefit of the society
4. Need to think innovatively to ensure Sustainability
5. Highlighting the depth of engagement possible within civil engineering and exploration of various possibilities of a career in this field

Content

Unit I: ***Civil Engineering and its historical developments;*** Understanding the importance of Civil Engineering in shaping and impacting the world; the ancient and modern Marvels and Wonders in the field of Civil Engineering; Scope of work involved in various branches of Civil Engineering and future vision; Recent Civil Engineering breakthroughs and innovations; Avenues for entrepreneurial working.

Unit II: ***Understanding the past to look into the future***; Pre-industrial revolution days, Agricultural revolution, first and second industrial revolutions, IT revolution and how these eras helped the civil engineering to grow; Concept of sustainability and the steady erosion of the environment due to haphazard developments; Global warming, its impact and possible causes; Atmospheric pollution; Pollution Mitigation measures; Health & Safety aspects for stakeholders; Environmental Impact Analysis: Concept and procedures; Innovations and methodologies for ensuring Sustainability.

Unit III: ***Infrastructure development and growth of the Nation***; its effects on the GDP, employment, living standards of the people, etc.; Introduction and overview to Futuristic systems: Megacities, Smart Cities, Stadia; Roads, Railways, Metros, Hyper Loop, Airports, Seaports, River ways, Sea canals, Tunnels, bridges.

Unit IV: ***Energy Generation***: Hydro, Solar, Wind, Wave, Tidal, Geothermal, Thermal energy; Telecommunication needs: towers, above-ground and underground cabling; Flood control: Dams, Canals, River interlinking; Energy efficient built-environments and LEED ratings; Awareness of various Codes & Standards governing Infrastructure development.

Suggested Readings

1 Salvadori, M and Heller, M, Strctures in Architectures, PHI.
2. Fintel, C, Handbook of Civil Engineering, CBS Publications.
3. *Žiga* Turk (2014), Global Challenges and the Role of Civil Engineering, Chapter 3 in: Fischinger M. (eds) Performance-Based Seismic Engineering: Vision for an Earthquake Resilient Society. Geotechnical, Geological and Earthquake Engineering, Vol. 32. Springer, Dordrecht
4. Brito, Ciampi, Vasconcelos, Amarol, Barros (2013) Engineering impacting Social, Economical and Working Environment, 120th ASEE Annual Conference and Exposition
5. NAE Grand Challenges for Engineering (2006), Engineering for the Developing World, The Bridge, Vol 34, No.2, Summer 2004

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Third Semester

S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
7	Professional Core courses	BTCE-306-18	**Surveying & Geomatics Lab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50

Course Outcomes

After completing the course the students must demonstrate the knowledge and ability to:

1. Assess horizontal & vertical angles by Theodolite.
2. Survey the area using different methods of plane tabling and compass survey and to adjust the compass traverse graphically.
3. Compute the reduce levels using various methods of leveling.
4. Predict the location of any point horizontally and vertically using Tachometry.
5. Setting out curves in the field.
6. Use electronic survey instruments.

Course Content

1. Measurement of bearing and angles with compass, adjustment of traverse by graphical method.
2. Different methods of leveling, height of instrument, rise & fall methods.
3. Measurement of horizontal and vertical angle by theodolite.
4. Determination of tachometric constants and determination of reduced levels by tachometric observations.
5. Plane table survey, different methods of plotting, three point problem.
6. Determination of height of an inaccessible object.
7. Setting out of circular curves in the field using different methods.
8. Plotting of traverse using the Total Station and GPS.

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Third Semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
8	Professional Core courses	BTCE-307-18	**Fluid MechanicsLab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50

Course Outcome

1 Select appropriate pressure measuring device under different condition of flow.
2 Determine the stability of a floating body.
3 Understand and apply Bernoulli's theorem practically.
4 Find discharge of fluid through pipe, orifices and in open channel.
5 Estimate the major and minor losses in pipe.
6 Estimate the various elements and energy losses in hydraulic jump.

Lab Experiments

1. To study of pressure measuring devices as peizometer, U-tube manometer, and pressure gauges.
2. To verify Bernoulli's Theorem
3. To determine the Meta centric height of a Floating Body under different condition.
4. To determine the coefficient of discharge of a Venturimeter.
5. To determine the coefficient of discharge of a Orifice Meter
6. To determine the coefficient of friction of different diameter pipes.
7. To estimate the minor losses as energy loss in pipe bend, sudden contraction or enlargement in pipe.
8. To determine the coefficient of discharge on rectangular and V-notches.
9. To determine the various element of a hydraulic jump.

Text/Reference Books

1. Fluid Mechanics and Machinery, C.S.P.Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010
2. Hydraulics and Fluid Mechanics, P M Modi and S M Seth, Standard Book House
3. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill
4. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

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Third Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
9	Professional Core courses	BTCE-308-18	**Solid Mechanics Lab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50

Course Outcomes

1. Understand the importance of physical properties of steel.
2. Identify and comprehend code provisions for testing different properties of steel.
3. Develop stress-strain curve for axial compression, axial tension and shear.
4. Assess hardness and impact strength of steel.
5. Assess flexural strength of a given material.
6. Evaluate fatigue and impact strength of steel.

Content

1. Determination of physical properties of steel including strength and ductility.
2. Study of tensile and compressive stress-strain behaviour of steel.
3. Compression test on brick.
4. Development of shear stress-strain curve for steel in torsion.
5. Determination of hardness of a material by Rockwell and Brinell hardness testing machine.
6. Determination of impact strength of a material by Izod and Charpy tests.
7. Determination of bending strength of a wooden beam specimen.
8. Determination of fatigue strength of a material.
9. Study of behavior of columns and struts with different end conditions.
10. To verify the moment area theorem for slope and deflection of a given beam.

Text/Reference Books

1.Laboratory Manual of Testing Materials, William Kendrick Hall

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Third Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
10	Professional core	BMPD-301-18	Mentoring and professional development	-	-	2	0

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B.

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

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Third Semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
10	Skill Enhancement	BTCE-332-18	**Training -I**	-	-	4	S/US

External Marks: 40, Internal Marks: 60, Total Marks: 100

Course Outcomes:
After completing this course the student must demonstrate the ability to:
1. Visualize things/ concepts and express the thoughts in the form of sketches, models, etc
2. Create a well organized document using computers
3. Work in teams
4. Acknowledge the work of other in a consistent manner
5. Understanding of ethical and professional issues
6. Demonstrate effective oral communication and presentation skills

Content
Module I – Institutional Training (3 weeks)

1. Hands-on-training on MS Office/ Office suite (Word processor, Spreadsheet, Math tools, presentation/ ppt, etc.)
2. Introduction to Civil Engineering software's and basic overview of drafting tools such as AutoCad, etc.

Module II – Field and Market Study

1. Student shall visit construction site of significantly scale and make an inventory construction and finishing materials being used.
2. Student shall do Market Survey for availability and rates of materials in the alreadyprepared inventory.

Note:

1. The students need to submit a summary report of the institutional training in Module I, and A detailed report/ scrapbook of inventory and market survey done in Module II.
2. The viva exam for the subject will be conducted along with the practical exams of the End-Semester Examination of Third Semester.

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4th Semester Syllabus

B. Tech Civil Engineering

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Fourth semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core courses	BTCE-401-18	**Concrete Technology**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

1. Understand the relevance of different properties of constituent materials on properties of concrete.
2. Understand the behavior and durability aspects of concrete under different loading and exposure conditions.
3. Understand the issues involved in production and use of concrete.
4. Design of concrete mixes as per BIS specifications.
5. Understand various testing methods for concrete and their applicability.
6. Knowledge of special type of non-conventional concretes.

Content:

Unit I: ***Concrete and its ingredients***: Properties of cement, aggregate, admixture, water and other additives; Related Indian Standard codes & guidelines.

Concrete behaviour in fresh and hardened states: Workability, Elasticity, Shrinkage, Creep, Fatigue, Strength in compression, tension, shear and bond; Influence of various factors on test results; Concrete cracking and type of cracks; Permeability and durability characteristics of concrete including resistance to sulphate & acid attack, alkali-aggregate reaction, freezing and thawing; Fire resistance.

Unit II: ***Production of concrete***: Mixing, handling, placing, compaction of concrete and related issues; Quality control; Behaviour in extreme environmental conditions like hot weather, cold weather and under water conditions.

Concrete mix design: Basic considerations, proportioning of material, effect of various parameters, trial mixes, Design by IS code.

Unit III: ***Inspection and testing of concrete***: Defects in concrete; Deterioration of concrete; Strength tests including compressive, split tensile, flexural, pullout etc.; Durability tests including permeability, carbonation, rapid chlorine ion penetration etc.; Destructive and Non-destructive testing of concrete; Acceptance and compliance requirements of concrete as per IS codes.

Unit IV: ***Special concretes:*** Types and specifications; Fibre reinforced and steel reinforced concrete; Polymer concrete; Light weight concrete, High strength concrete, Prestressed concrete, Self Compacting Concrete, Pervious Concrete, Self Healing Concrete.

Text/Reference Books

1. 'Properties of Concrete', A. M. Neville, Prentice Hall
2. 'Concrete Technology', M. S. Shetty, S.Chand & Co.
3. 'Concrete Technology', M. L. Gambhir, Tata McGraw Hill Publishers, New Delhi
4. 'Concrete Technology', A. R. Santha Kumar, Oxford University Press, New Delhi

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Fourth semester

S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
2	Professional Core courses	BTCE-402-18	**Materials, Testing & Evaluation**	4	0	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

1. Appraisal about the role of materials in civil engineering
2. Introduce common measurement instruments, equipments and devices to capture the material response under loading
3. Exposure to a variety of established material testing procedures/techniques and the relevant codes of practice
4. Ability to write a technical laboratory report.

Unit-I: Introduction to Engineering Materials: Types, properties, advantages and uses of: Cement; Concrete; Admixtures; Glass and Plastics; Paints and Varnishes,; Acoustical material; Geo-synthetics, Bitumen and Asphalt; Ceramics and Refractory's ;Bricks; Concrete hollow blocks & Interlocking tiles.

Sand: Composition, types, Physical Properties, uses. Fly ash: Source, types, properties and uses Timbers: Properties, Seasoning, defects, preservation methods, laminates and adhesives,

Unit-II: Ferrous and nonferrous metals, Importance of Structural steel; Their characteristics and mechanical behaviour (elastic, plastic and elasto plastic, strength and durability w.r.t Climatic variation); Creep – fundaments and characteristics, concept of fatigue of materials; Impact test, toughness – different materials.

Unit-III: Testing Procedures for bricks, reinforcing steel, fine aggregates, coarse aggregates, Physical identification of tests for soils. Documenting the experimental program, including the test procedures, collected data, method of interpretation and final results.

Unit-IV: Quality control- Use of test data/ testing reports in the material selection for various civil engineering projects /construction, Sampling, Acceptance criterion, Code of practice and guidelines in this regards for Cements; Aggregates; Concrete (plain and reinforced); Soils; Bitumen and asphaltic materials; Timbers; Glass and Plastics; Structural Steel.

Text/Reference Books:

1. Chudley, R., Greeno (2006), 'Building Construction Handbook' (6th ed.),R. Butterworth- Heinemann

2.Khanna, S.K., Justo, C.E.G and Veeraragavan, A, ' Highway Materials and Pavement Testing', Nem Chand & Bros, Fifth Edition

3.Various related updated & recent standards of BIS, IRC, ASTM, RILEM, AASHTO, etc. correspondingto materials used for Civil Engineering applications

4.Kyriakos Komvopoulos (2011), Mechanical Testing of Engineering Materials, Cognella

5.E.N. Dowling (1993), Mechanical Behaviour of Materials, Prentice Hall International Edition

6.American Society for Testing and Materials (ASTM), Annual Book of ASTM Standards

(post 2000)

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Fourth semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
3	Professional Core courses	BTCE-403-18	**Hydrology & Water Resources Engineering**	3	1	0	4

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External Marks: 60, Internal Marks: 40, Total Marks: 100

Outcomes

At the end of the course, students must be in a position to:

1 Understand the interaction among various processes in the hydrologic cycle.

2 Calculate the average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, evapotranspiration etc

3 Understand the various component of hydro graphs and able to estimate the run off.

4 Find the water requirement for different crops and able to proposed appropriate method of applying water.

5 Understand the distribution system of canal and various components of irrigation system.

6 Classify dams and spillways, their problems and able to determine forces exerted by fluid on dams.

Content

Unit I: *Introduction* - Hydrologic Cycle, History of Hydrology, Water-Budget Equation, , World Water Balance, Applications in Engineering, Sources of Data.

***Precipitation* -** Forms of Precipitation, Characteristics of Precipitation in India, Measurement of Precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth Area-Duration Relationships, Maximum Intensity/Depth-Duration-Frequency Relationship, Probable Maximum Precipitation (PMP), Rainfall Data in India.

Unit II: *Abstractions from precipitation* - Evaporation Process, Evaporimeters, Analytical Methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapotranspiration, Interception, Depression Storage, Infiltration, Infiltration Capacity, Measurement of Infiltration, Modelling Infiltration Capacity, Classification of Infiltration Capacities, Infiltration Indices.

***Runoff* -** Runoff Volume, SCS-CN Method of estimating runoff volume, Flow Duration Curve, Flow-Mass Curve, Hydrograph, Factors Affecting Runoff Hydrograph, Components of Hydrograph, Base Flow Separation, Effective Rainfall, Unit Hydrograph Surface Water Resources of India, Environmental Flows.

Unit III: *Water withdrawals and uses* – Water for Energy Production, Water for Agriculture, Water for Hydroelectric Generation; Flood Control. Analysis of Surface Water Supply, Water Requirement of Crops-Crops and Crop Seasons in India, Cropping Pattern, Duty And Delta; Quality of Irrigation Water; Soil-Water Relationships, Root Zone Soil Water, Infiltration, Consumptive use, Irrigation Requirement, Frequency of Irrigation; Methods of Applying Water to The Fields: Surface, Sub-Surface, Sprinkler and Trickle / Drip Irrigation.

***Distribution systems* -** Canal Systems, Alignment of Canals, Canal Losses, Estimation of Design Discharge. Design of Channels- Rigid Boundary Channels, Alluvial Channels, Kennedy's and Lacey's Theory of Regime Channels. Canal Outlets: Non-Modular, Semi-Modular And Modular Outlets.

Unit IV: *Water Logging*: Causes, Effects And Remedial Measures. Lining of Canals, Types of Lining. Drainage of Irrigated Lands: Necessity, Methods.

***Dams and spillways* -** embankment dams: Classification, design considerations, estimation and control of seepage, slope protection. Gravity dams: forces on gravity dams, causes of failure, stress analysis, elementary and practical profile. Arch and buttress dams. Spillways: components of spillways, types of gates for spillway crests; Reservoirs- Types, capacity of reservoirs, yield of reservoir, reservoir regulation, sedimentation, economic height of dam, selection of suitable site.

Text/Reference Books

1. K Subramanya, Engineering Hydrology, Mc-Graw Hill.
2. K N Muthreja, Applied Hydrology, Tata Mc-Graw Hill.
3. K Subramanya, Water Resources Engineering through Objective Questions, Tata McGraw Hill.
4. G L Asawa, Irrigation Engineering, Wiley Eastern
5. L W Mays, Water Resources Engineering, Wiley.
6. J. D Zimmerman, Irrigation, John Wiley & Sons
7. C S P Ojha, R Berndtsson and P Bhunya, Engineering Hydrology, Oxford.

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Fourth semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
4	Professional Core courses	BTCE-404-18	**Transportation Engineering**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

After completing this course the student must demonstrate the knowledge and ability to:

1. Appreciate the importance of different modes of transportation and characterize the road transportation.
2. Alignment and geometry of pavement as per Indian Standards according to topography.
3. Assess the properties of highway materials in laboratory
4. Understand the importance of railway infrastructure planning and design.
5. Identify the functions of different component of railway track.
6. Outline the importance of Airport Infrastructure

Course Content

Unit I: *Introduction:* Importance of Transportation, Different Modes of Transportation, Characteristics of Road Transport.

Transportation Systems*:* Multi modal transportation system, Characteristics of Mass Transit systems including technical, demand operational and economic problems, fixed Track Facility, Mass Rapid Transit System- Elevated, Surface and Underground construction, Express Bus System, integrated Operating Characteristics of Terminal and Transfer facilities.

Unit II: *Highway Development & Planning**:* Principles of Highway Planning, Road Development in India, Classification of Roads, Road Patterns, Planning Surveys; Highway Construction: Right of way; Earthen/Gravel Road, Water Bound Macadam, Wet Mix Macadam, Bituminous Pavements, Cement Concrete Pavements

Unit III: *Railway Engineering**:* History of Railways, Development of Indian Railway, Organisation of Indian Railway, Important Statistics of Indian Railways. Railway Gauges: Definition, Gauges on World Railways, Choice of Gauge, Uniformity of Gauge, Loading Gauge, Construction Gauge.

Railway Track*:* Requirements of a Good Track, Track Specifications, Detailed Cross-Section of Single/Double Track used in Indian Railways. Components of permanent way - Rails, Sleepers, Ballast, Sub-grade and Formation, Track Fixtures & Fastenings, Coning of Wheels, Tilting of Rails, Adzing of Sleepers, Rail Joints, Creep of Rails.

Unit IV: *Airport Engineering*: Introduction, Air Transport Scenario in India and Stages of Development, National and International Organizations; Airport planning - Site selection, runway orientation, etc. Concept of Head Wind, Cross Wind, Wind Rose Diagram, Runway Configuration.

Aircraft Parking System & Visual Aids*:* Main Taxiway, Exit Taxiway, Separation Clearance, Holding Aprons.: Marking and Lighting of Runway and Taxiway, Landing Direction Indicator, and Wind Direction Indicator, IFR/VFR.

References

• Khanna S.K., and Justo, C.E.G. "Highway Engineering", Nem Chand and Brothers, Roorkee,1998.
• Kadiyali, L.R. "Principles and Practice of Highway Engineering", Khanna Publishers, New Delhi, 1997.
• Flaherty, C.A.O. "Highway Engineering", Volume 2, Edward Arnold, London, 1986.
• Sharma, S.K. "Principles, Practice & Design of Highway Engineering", S. Chand & Company Ltd., New Delhi, 1985.
• Mannering, "Principles of Highway Engineering & Traffic Analysis", Wiley Publishers, NewDelhi.

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Fourth semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
5	Professional Core courses	BTCE-405-18	**Disaster Preparedness & Planning**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

After completing this course the student must demonstrate the knowledge and ability to:

1. Identify various types of disasters, their causes, effects & mitigation measures.
2. Demonstrate the understanding of various phases of disaster management cycle and create vulnerability and risk maps.
3. Understand the use of emergency management system to tackle the problems.
4. Discuss the role of media, various agencies and organisations for effective disaster management.
5. Design early warning system and understand the utilization of advanced technologies in disaster management.
6. Compare different models for disaster management and plan & design of infrastructure for effective disaster management.

Content

Unit I: *Introduction to Disaster Management:* Define and describe disaster, hazard, vulnerability, risk-severity, frequency and details, capacity, impact, prevention, mitigation.

***Disasters**:* Identify and describe the types of natural and manmade disasters, hazard and vulnerability profile of India, mountain and coastal areas, Factors affecting vulnerability such as impact of development projects and environment modifications (including dams, land-use changes, urbanization etc.), Disaster impacts (environmental, physical, social, ecological, economic etc.); health, psycho-social issues; demographic aspects (gender, age, special needs), Lessons and experiences from important disasters with specific reference to civil engineering.

Unit II: *Disaster Mitigation and Preparedness:* Disaster Management Cycle-its phases; prevention, mitigation, preparedness, relief and recovery; structural and non structural measures; Preparedness for natural disasters in urban areas.

***Risk Assessment**:* Assessment of capacity, vulnerability and risk, vulnerability and risk mapping, stages in disaster recovery and associated problems; Use of Remote Sensing Systems (RSS) and GIS in disaster Management, early warning systems.

Unit III : ***Post disaster response**:* Emergency medical and public health services; Environmental post disaster response (water, sanitation, food safety, waste management, disease control, security, communications); reconstruction and rehabilitation; Roles and responsibilities of government, community, local institutions, role of agencies like NDMA, SDMA and other International agencies, organizational structure, role of insurance sector, DM act and NDMA guidelines.

Unit IV: *Integration of public policy:* Planning and design of infrastructure for disaster management, Community based approach in disaster management, methods for effective dissemination of information, ecological and sustainable development models for disaster management.

Books and References

1. www.http//ndma.gov.in
2. http://www.ndmindia.nic.in
3. Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill, Publisher
4. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester 92
5. Singh B.K., 2008, Handbook of disaster management: Techniques & Guidelines, Rajat Publications.
6. Disaster Management, R.B. Singh (Ed), Rawat Publications
7. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction

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Fourth semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
7	Mandatory Courses (Non Credit)	EVS-101-18	**Environmental Science**	3	0	0	0

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*** 40 Hours are kept for various activities under the head of activities. There will be a final theory examination for the students of 100 marks but these marks will not be added to their final result as assessment will be satisfactory or non-satisfactory**

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around us. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects this ethos. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students

Course Outcomes:

1. Students will enable to understand environmental problems at local and national level through literature and general awareness.

2. The students will gain practical knowledge by visiting wildlife areas, environmental institutes and various personalities who have done practical work on various environmental Issues.

3. The students will apply interdisciplinary approach to understand key environmental issues and critically analyze them to explore the possibilities to mitigate these problems.

4. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

Detailed Contents

Unit- I : Natural Resources :Renewable and non-renewable resources

Natural resources and associated problems.Forest resources: Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people. Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies. Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources, Equitable use of resoureces for sustainable lifestyles.

Unit-II : Ecosystems : Concept of an ecosystem, Structure and function of an ecosystem, Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of following ecosystems: a. Forest ecosystem b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Unit-III : Biodiversity and its conservation : Introduction – Definition : genetic, species and ecosystem diversity, Biodiversity at global, National and local levels, India as a mega-diversity nation, Hot-sports of biodiversity, Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India

Unit-IV : Social Issues and the Environment : From Unsustainable to Sustainable development, Resettlement and rehabilitation of people; its problems and concerns., Environmental ethics : Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust, Case Studies, Public awareness.

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***ACTIVITIES**

Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity

Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.

Following activities must be included.

Identify a tree fruit flower peculiar to a place or having origin from the place.Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).Videography/ photography/ information collections on specialties/unique features of different types of common creatures. Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.

1 *(A) Awareness Activities:*

a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) h) Cleanliness drive i) Drive for segrega
i) tion of waste
i) To live with some eminent environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess
j) To know about the different varieties of plants
k) Shutting down the fans and ACs of the campus for an hour or so
l) Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
n) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

References & Books

1. Textbook of Environmental studies, Erach Bharucha, UGC Weblink: https://www.ugc.ac.in/oldpdf/modelcurriculum/env.pdf
2. Environmental Studies by Poonia, M.P and Sharma, S.C, Khanna publishing
3. Fundamental concepts in Environmental Studies, D D Mishra, S Chand & Co Ltd
4. Environment Biology by Agarwal, K. C., Nidi Publ. Ltd. Bikaner.
5. Principle of Environment Science by Cunninghan, W.P.
6. Essentials of Environment Science by Joseph.
7. Perspectives in Environmental Studies by Kaushik, A.
8. Elements of Environment Science & Engineering by Meenakshi.
9. Elements of Environment Engineering by Duggal.

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Fourth semester

S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
6	Professional Core courses	BTCE-406-18	**Concrete Testing Lab**	0	0	2	1

External Marks: 40, Internal Marks: 60, Total Marks: 100

Course Outcomes

1. Evaluate properties of building materials, such as cement and aggregates.
2. Conduct experiments and check the acceptance criteria (if any).
3. Design concrete mixes as per BIS provisions.
4. Analyze the properties of concrete in fresh and hardened state.
5. Create a well organized document and present the results appropriately.
6. Understand and apply non destructive testing (NDT) for evaluating concrete quality.

Content

1. Tests on cement
    - Fineness
    - Consistency
    - Setting time
    - Soundness
    - Specific gravity
    - Strength
2. Tests on aggregates (fine and coarse)
    - Specific gravity
    - Bulk Density
    - Fineness Modulus
    - Moisture content
    - Water Absorption
    - Bulking of sand
3. Design mix of concrete as per BIS method.
4. Workability tests on concrete
    - Slump test
    - Compaction Factor test
    - Vee-Bee test
5. Strength tests on concrete
    - Compressive strength (Cube and Cylinder)
    - Split Tensile strength
    - Flexural strength
    - Abrasion resistance
6. Non-Destructive Techniques
    - Rebound hammer test
    - Ultra sonic pulse velocity test

Text/Reference Books

1. ‘Concrete Lab Manual’, M. L. Gambhir, Dhanpat Rai & Sons, New Delhi.
2. ‘Concrete Lab Manual’, TTTI Chandigarh.

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Fourth semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
7	Professional Core courses	BTCE-407-18	**Transportation Lab**	0	0	2	1

External Marks: 40, Internal Marks: 60, Total Marks: 100

Course Outcomes

After completing this course the student must demonstrate the knowledge and ability to:
1.Characterize the pavement materials as per the Indian Standard guidelines.
2. Evaluate the strength of subgrade soil by CBR test.
3.Conduct experiments to evaluate aggregate properties.
4.Determine properties of bitumen material and mixes
5.Evaluate the pavement condition by rough meter and Benkelman beam test.
6.Create a well organized report and present the results appropriately

Course Content

I Tests on Sub-grade Soil
1.. California Bearing Ratio Test

II Tests on Road Aggregates
2. Crushing Value Test
3. Los Angles Abrasion Value Test
4. Impact Value Test
5. Shape Test (Flakiness and Elongation Index)

III *Tests on Bituminous Materials and Mixes*
6. Penetration Test
7. Ductility Test
8. Softening Point Test
9. Flash & Fire Point Test
10. Bitumen Extraction Test

IV *Field Tests*
11. Study of Roughometer/Bump Indicator
12. Study of Benkelman Beam Method

References

Khanna S.K., and Justo, C.E.G. “Highway Material & Pavement Testing”, NemChand andBrothers, Roorkee.

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Fourth semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
8	Professional Skill enhancement	BTCE-432-18	**Training-II**	-	-	-	S/US

Content

Module I – Survey camp of an area (2 weeks)

1. Hands-on-training of modern surveying equipment such as Digital Theodolite, Total Stations, Autolevel, and GPS.
2. On-site application of traversing, etc. for preparation of topographical maps of an area.

Module II – 4 week Summer Internship in Industry/ Construction site/ Appropriate workplace

Note:

1. The students need to submit a topographical maps preaperd in Survey Camp and a report of the summer internship.
2. The viva exam for the subject will be conducted alongwith the practical exams of the End-Semster Examination of Fifth Semester.

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Fourth semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
9	Professional core	BMPD- 401-18	**Mentoring and professional development**	-	-	2	0

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B.

Mentors/Faculty in charges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

5th Semester Syllabus

B. Tech Civil Engineering

Fifth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Professional Core courses	BTCE-501-18	**Engineering Geology**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students understand:
1. The basic concepts of geological processes and their importance in civil Engineering
2. Identification of rocks and minerals and their characteristics
3. Significance of geological structures and processes in civil engineering projects
4. Site characterization and geologic considerations in construction

Content

Unit-I: General Geology: Scope of geology in Civil Engineering - the earth, its structure and environment - Standard geological time scale, unit & fossils. physiographic, stratigraphic and tectonic divisions of India - geomorphological (surface) processes – weathering – types , weathered products, assessment of degree of weathering , Fluvial processes, glaciation, wind action, and their significance in Civil Engineering

Unit-II: Mineralogy and Petrology: Physical properties of minerals – classification - study of important rock forming minerals – Quartz family, feldspar family, Augite, Hornblend, Mica family, calcite, Iron oxide minerals, Augite, Hornblend, and Clay minerals and their behaviour and significance in the field of Civil Engineering . Classification of rock - mode of formation - distinction between igneous, sedimentary and metamorphic rocks. Formation, textures, structure, Classification, and Engineering, Characteristic of rocks. Study of imp rocks granite, syenite, diorite, gabbro, pegmatite, dolerite , basalt , sand stone, limestone, shale, breccia , conglomerate , gneiss, quartzite, marble, slate, schist, phyllite and conglomerate

Unit -III: Strength Behavior of Rocks- Stress and Strain in rocks. Concept of Rock Deformation & Tectonics. Dip and Strike. Outcrop and width of outcrop. Inliers and Outliers. Main types of discontinuities according to size. Fold- Types and nomenclature, Criteria for their recognition in field. Faults: Classification, recognition in field, effects on outcrops. Joints & Unconformity; Types, Stresses responsible, geotechnical importance. Importance of structural elements in engineering operations. Consequences of failure as land sliding, Earthquake and Subsidence. Strength of Igneous rock structures.

Unit IV:Geological Hazards- Rock Instability and Slope movement: Concept of sliding blocks. Different controlling factors. Instability in vertical rock structures and measures to prevent collapse. . Types of landslide. Prevention by surface drainage, slope reinforcement by Rock bolting and Rock anchoring, retaining wall, Slope treatment. Case study on black clay. Ground water: Factors controlling water bearing capacity of rock. Pervious & impervious rocks and ground water. Lowering of water table and Subsidence. Earthquake: Magnitude and intensity of earthquake. Seismic sea waves. Revelation from Seismic Records of structure of earth. Case Study on Elevation and Subsidence

Unit V: Rock masses as construction material: Definition of Rock masses. Main features constituting rock mass. Main features that affects the quality of rock engineering and design.Basic element and structures of rock those are relevant in civil engineering areas. Main types of works connected to rocks and rock masses. Important variables influencing rock properties and behavior such as Fresh rock Influence from some minerals. Effect of alteration and weathering. Measurement of velocity of sound in rock. Classification of Rock material strength. Core logging .Rock Quality Designation. Rock mass description.

Unit VI: Geology of dam and reservoir site- Required geological consideration for selecting dam and reservoir site. Failure of Reservoir. Favorable & unfavorable conditions in different types of rocks in presence of various structural features, precautions to be taken to counteract unsuitable conditions, significance of discontinuities on the dam site and treatment giving to such structures.

Text/Reference Books:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C.Harvey, Cambridge University Press (1982).
4. Reddy,D.," Engineering Geology for Civil Engineers", Oxford & IBH , 1995
5. Leggot, R.F.," Geology and Engineers ", McGraw Hill , New York.2002 2.
6. Blyth, F.G.M., " A Geology for Engineers", Arnold, Londo,(2003.
7. Bell.F.G, " Fundamentals of Engineering Geology" Butterworth, 1983

Fifth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
2	Professional Core courses	BTCE-502-18	**Elements of Earthquake Engineering**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students to:

i) Appreciate the role of earthquake forces in structural design of building.
ii) Apply various codal provisions related to seismic design of buildings.
iii) Acquire new basic knowledge in earthquake engineering

Content

Unit 1: Introduction to Earthquakes, Causes of Earthquakes, Basic Terminology, Magnitude, Intensity, Peak ground motion parameters.

Unit 2: Past Earthquakes and Lessons learnt, Various Types of Damages to Buildings.

Unit 3: Introduction to theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, Spring action and damping, Equation of motion of S.D.O.F. systems, Undamped, Damped system subjected to transient forces, general solution, green's function.

Unit 4: Lateral Force analysis, Floor Diaphragm action, moment resisting frames, shear walls.

Unit 5: Concepts of seismic design, Lateral Strength, Stiffness, ductility and structural configuration.

Unit 6: Introduction to provisions of IS 1893-2002 Part-I for buildings. Estimation of lateral forces due to earthquake.

Unit 7: Introduction to provisions of IS 4326.

Unit 8: Introduction to provision of IS 13920.

Text /Reference Books :

1. Earthquake Resistant Design of Structures, Pankaj Agrawal, Manish Shrikhande, PHI Learning

2. Dynamics of Structures: Theory and Applications to Earthquake Engineering, AK Chopra, Prentice Hall
3. Dynamics of Structures, R.W. Clough and Joseph Penzien, McGraw-Hill Education
4. Structural Dynamics by Mario & Paz, Springer.
5. Earthquake Resistant Design by David J. Dowrick, Wiley India Pvt Ltd
6. Elements of Earthquake Engg by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, South Asian Publishers.
7. IS 1893-2016Indian Standard Criteria for Earthquake Resistant Design of Structures.
8. IS 4326-1993 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
9. IS 13920:2016- Ductile design and detailing of Reinforced Concrete Structures subjected to Seismic Forces- code of practice

Fifth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
3	Professional Core courses	BTCE-503-18	**Construction Engineering & Management**	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students to:

An idea of
how structures are built and projects are developed on the field

i. An understanding of modern construction practices
ii. A good idea of basic construction dynamics- various stakeholders, project objectives,
iii. processes, resources required and project economics

iv. A basic ability to plan, control and monitor construction projects with respect to time
v. and cost
vi. An idea of how to optimise construction projects based on costs
vii. An idea how construction projects are administered with respect to contract structures and issues.
viii. An ability to put forward ideas and understandings to others with effective communication processes

Contents

Unit 1: *Basics of* Construction- Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution;

Unit 2: Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion

.

Unit 3: Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic construction methods for steel structures; Basics of construction methods for Bridges.

Unit 4: Construction Equipment basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities.

Unit 5: Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow,sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction.

Unit 6:*Project Monitoring & Control*- Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health.

Unit 7:*Contracts Management basics:* Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

Unit 8:*Construction Costs: Make-up of construction costs;* Classification of costs, timecost trade-off in construction projects, compression and decompression.

Text/Reference Books:

1. Varghese, P.C., "*Building Construction*", Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

Fifth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
4	Professional Core courses	BTCE-504-18	**Environmental Engineering**	4	0	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students to:

i. Understand the impact of humans on environment and environment on humans
ii. Be able to identify and value the effect of the pollutants on the environment: atmosphere, water and soil.
iii. Be able to plan strategies to control, reduce and monitor pollution.
iv. Be able to select the most appropriate technique for the treatment of water, wastewater ,solid waste and contaminated air.
v. Be conversant with basic environmental legislation.

Contents

Unit1: *Water:* **-**Sources of Water and quality issues, water quality requirement for different beneficial uses, Water quality standards, water quality indices, water safety plans, Water Supply systems, Need for planned water supply schemes, Water demand industrial and agricultural water requirements, Components of water supply system; Transmission of water, Distribution system, Various valves used in W/S systems, service reservoirs and design. *Water Treatment:* aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes

Unit 2: *Sewage***-** Domestic and Storm water, Quantity of Sewage, Sewage flow variations.Conveyance of sewage**-** Sewers, shapes design parameters, operation and maintenance of sewers, Sewage pumping; Sewerage, Sewer appurtenances, Design of sewerage systems. Small bore systems, Storm Water**-** Quantification and design of Storm water; Sewage and Sullage, Pollution due to improper disposal of sewage, Wastewater treatment, aerobic and anaerobic treatment systems, suspended and attached growth systems, recycling of sewage – quality requirements for various purposes.

Unit 3: *Air* **-** Composition and properties of air, Quantification of air pollutants, Monitoring of air pollutants, Air pollution**-** Occupational hazards, Urban air pollution automobile pollution, Air quality standards, Control measures for Air pollution.

Unit 4: *Noise***-** Basic concept, measurement and various control methods.

Unit 5:*Solid waste management*-Municipal solid waste, Composition and various chemical and physical parameters of MSW, MSW management: Collection, transport, treatment and disposal of MSW. Special MSW: waste from commercial establishments and other urban areas, solid waste from construction activities, biomedical wastes, Effects of solid waste on environment: effects on air, soil, water surface and ground health hazards. Disposal of solid waste-segregation, reduction at source, recovery and recycle. Disposal methods**-** Integrated solid waste management.

Unit 6: *Building Plumbing*-Introduction to various types of home plumbing systems for water supply and waste water disposal, high rise building plumbing, Storage tanks, Building drainage for high rise buildings, various kinds of fixtures and fittings used.

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Text/Reference Books:

1. Introduction to Environmental Engineering and Science by Gilbert Masters, Prentice Hall, New Jersey.
2. Introduction to Environmental Engineering by P. Aarne Vesilind, Susan M. Morgan, Thompson /Brooks/Cole; Second Edition 2008.
3. Peavy, H.s, Rowe, D.R, Tchobanoglous, G. *Environmental Engineering*, Mc-Graw -Hill International Editions, New York 1985.
4. MetCalf and Eddy. *Wastewater Engineering, Treatment, Disposal and Reuse*, Tata McGraw-Hill, New Delhi.
5. Manual on Water Supply and Treatment. Ministry of Urban Development, New Delhi.
6. Plumbing Engineering. Theory, Design and Practice, S.M. Patil, 1999
7. Integrated Solid Waste Management, Tchobanoglous, Theissen & Vigil. McGraw Hill Publication
8. Manual on Sewerage and Sewage Treatment Systems, Part A, B and C. Central Public Health and Environmental Engineering Organization, Ministry of Urban Development

Fifth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
5	Professional Core courses	BTCE-505-18	**Structural Engineering**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcome

The course will enable the students to:

i. The students will be able to apply their knowledge of structural mechanics in addressing design problems of structural engineering
ii. They will possess the skills to analyse and design concrete and steel structures
iii. They will have knowledge of structural engineering

Unit 1: Introduction

Structural Engineering, role of structural engineer, engineer, architect, builder; Objectives of designing a structure,safety,sustainable development in performance.

Unit 2: Structural Analysis

Concept of determinacy and indeterminacy, Analyses of indeterminate beams, frames and trusses using Slope deflection method, Moment distribution method, unit load method and castiglano's theorem.

Unit 3: Design of concrete Elements

Design Philosophies of Working Stress Method and Limit State Method, Design of Reinforced Concrete Beams for Flexure, Shear; Bond, Anchorage, development length and torsion; Reinforced Concrete Axially Loaded Columns, Reinforced Concrete Slabs: One Way and Two Way.

Unit 4: Design of Steel Elements
Properties of structural steel, I.S. rolled sections, I.S. specifications; Connections- Bolted and welded connections for axial loads; Tension members: Design of members subjected to axial tension; Compression members: Design of axially loaded members, built-up columns, laced and battened columns; Flexural members: Design of laterally restrained and un-restrained rolled section beams.

Text/Reference Books:

1. Nilson, A. H. Design of Concrete Structures. 13th edition. McGraw Hill, 2004
2. McCormac, J.C., Nelson, J.K. Jr., Structural Steel Design. 3rd edition. Prentice Hall, N.J., 2003.
3. Intermediate Structural Analysis - C K Wang, McGraw hill publications.
4. Limit state design of steel structures: S K Duggal, Mc Graw Hill.
5. Design of Reinforced Concrete Structures: S. Ramamrutham, Dhanpat Rai Publications.
6. Smith, J. C., Structural Analysis, Harpor and Row, Publishers, New York.
7. NBC, National Building Code, BIS (2017).
8. Theory of structures - S Ramamurtham, Dhanpat Rai Publications.
9. Theory of structures - B.C. Punima, Laxmi Publications.
10. Reinforced concrete design - Pillai & Menon, Tata McGrawHill publications

BIS Codes of practice and Design Handbooks:

1. *IS 456-2000- Indian Standard. Plain and Reinforced concrete -Code of practice
2. *Design Aid SP 16
3. *IS 800: 2007 (General construction in steel-Code of practice)*
4. *SP: 6(1) (Handbook for structural engineers-Structural steel sections
5. Explanatory hand book SP24.
6. Detailing of Reinforcement SP 34

Note: The codes marked with * are permitted in examination.

Fifth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
6	Professional Core courses#	BTCE-506-18	**Geotechnical Engineering#**	3	0	0	3

After studying this course, students shall be able to:

1. Comprehend the various geotechnical field challenges and understand their fundamental, index and engineering properties and then use (apply) the soil as an engineering material.
2. Investigate and write the laboratory reports for soil design properties and parameters by apply the concept of permeability, total and effective stress approaches in soil strength determination
3. Apply the various specifications of compaction of soils in the construction of highways and earthen dams.
4. Able to apply the knowledge of consolidation, soil deformation parameters, and calculate settlement magnitude and rate of settlement.
5. Design the embankment slopes and check the stability of finite slopes.

Unit-I:*Basic Concepts*- Definition of soil, Comparison between soil mechanics, rock mechanics and geotechnical engineering, Scope of soil mechanics problems in Civil Engineering. Principal types of soils in India. Characteristics of main Clay mineral groups. Soil as three phase system: weight volume relationship and determination of moisture content from nuclear method, alcohol method and sensors. Determination of Specific gravity by density bottle method, pycnometer method. Field density from sand replacement method and other methods.

Index Properties: Grain size analysis. Stokes's law and Hydrometer analysis. Consistency and sensitivity of Clay, Atterbeg Limits, Flow Index and Toughness Index. Underlying theory of shrinkage limit determination. Classification of coarse and fine grained soils as per Indian Standard.

Unit-II :*Permeability of Soil*- Darcy's law, validity of Darcy's law. Determination of coefficient of permeability: Laboratory method: constant-head method, falling-head method. Field method: pumping- in test, pumping- out test. Permeability aspects: permeability of stratified soils, factors affecting permeability of soil. Seepage Analysis-Introduction, stream and potential functions, characteristics of flow nets, graphical method to plot flow nets.
***Effective Stress Principle*-** Introduction, effective stress principle, nature of effective stress, effect of water table. Fluctuations of effective stress, effective stress in soils saturated by capillary action, seepage pressure, quick sand condition.

Unit-III:*Compaction of Soil*-Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Compaction in field, compaction specifications and field control.
***Consolidation of Soil* -** Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, interpretation of consolidation test results, Terzaghi's theory of consolidation, Concept of various consolidation characteristics i.e. av, mv and cv, primary and secondary consolidation concept of cv, tv& U. Consolidation test: determination of cv from curve fitting methods, Pre consolidation pressure determination. Normally consolidated and over consolidated clays. Causes of over-consolidation. Effect disturbance on e-Log σ curves of normally consolidated clays, importance of consolidation settlement in the design of structures. final settlement of soil deposits, computation of consolidation settlement and secondary consolidation.

Unit-IV: *Shear Strength*- Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, triaxial compression tests, test behaviour of UU, CU and CD tests, pore-pressure measurement, computation of effective shear strength parameters. unconfined compression test, vane shear test

***Stability of Slopes*-** Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts

Text/Reference Books:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. Soil Mech. & Foundation Engg, by K.R.Arora Standard *Publishers* Distributors
4. Geotechnical Engineering, by P. Purshotama Raj *Tata Mcgraw Hill*
5. Soil Mech. & Foundation Engg., by V.N.S.Murthy CBS *Publishers* & Distributors.
6. Principle of Geotechnical Engineering by B.M.Das Cengage Publisher
7. Basic and applied Soil Mechanics by Gopal Ranjan and A.S. R. Rao New Age International Publishers
8. Geotechnical Engineering by Gulati and Datta, Tata McGraw Hill
9. Problems in Soil mechanics and Foundation Engineering by B.P.Verma, Khanna Publishers.

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
7	Professional Core courses	BTCE-507-18	**Geotechnical Lab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50
.

1. Determination of in-situ density by core cutter method and Sand replacement method.
2. Determination of Liquid Limit & Plastic Limit.
3. Determination of specific gravity of soil solids by pyconometer method.
4. Grain size analysis of sand and determination of uniformity coefficient (Cu) and coefficient of curvature (Cc).
5. Compaction test of soil.
6. Determination of Relative Density of soil.
7. Determination of permeability by Constant Head Method.
8. Determination of permeability by Variable Head method.
9. Unconfined Compression Test for fine grained soil.
10. Direct Shear Test
11. Triaxial Test
12. Swell Pressure Test

Books Recommended:-

Soil Testing Engineering, Manual By Shamsher Prakash and P.K. Jain. Nem Chand & Brothers

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
8	Professional Core courses	BTCE-508-18	**Environmental Engineering Lab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50

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1. To measure the pH value of a water/waste water sample.
2. To determine optimum Alum dose for Coagulation.
3. To find MPN for the bacteriological examination of water.
4. To find the turbidity of a given waste water/water sample
5. To find B.O.D. of a given waste water sample.
6. To measure D.O. of a given sample of water.
7. Determination of Hardness of a given water sample
8. Determination of total solids, dissolved solids, suspended solids of a given water sample.
9. To determine the concentration of sulphates in water/wastewater sample.
10. To find chlorides in a given sample of water/waste water.
11. To find acidity/alkalinity of a given water sample
12. To determine the COD of a wastewater sample.

Books Recommended:

1. Chemistry for Enviromental Engg. and Science by Sawyer & McCarty, TMH, New Delhi
2. Standard Methods for the examination of water & wastewater, APHA, AWWA, WE

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
9	Professional Core courses	BTCE-509-18	**Structural Lab**	0	0	2	1

External Marks: 20, Internal Marks: 30, Total Marks: 50
.

1. Deflection of a simply supported beam and verification of Clark-Maxwell's theorem.
2. To determine the Flexural Rigidity of a given beam.
3. Deflection of a fixed beam and influence line for reactions.
4. Deflection studies for a overhang beam and influence line for reactions.
5. Structural Drawings of Reinforced Concrete Elements such as Beams, Slabs.
6. Structural Drawings of Steel Elements such as Connections, Tension Members, Compression Members, Beams,

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
10	Professional core	BMPD-501-18	**Mentoring and professional development**	-	-	2	0

Guidelines regarding Mentoring and Professional Development

The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B.

Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

6th Semester Syllabus

B. Tech Civil Engineering

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Professional Core courses#	**BTCE-601-18**	**Engineering Economics, Estimation &Costing**	3	1	0	4

Course outcomes: On completion of the course, the students will:

1. Have an idea of basic principles and elements of economics in general.
2. Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
3. Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
4. Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
5. Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

Unit-1: **Basic Principles of Economics**

Demand/Supply – elasticity – Basic Macroeconomic Concepts (including GDP/GNP/NI/ Disposable Income), Aggregate demand and Supply (IS/LM), Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes.

Unit-2: Elements of Business/Managerial Economics

Cost & Cost Control -Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money.

Unit-3: Estimation / Measurements for various items

Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying.

Unit-4: Specifications

Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures.

Unit-5: Rate analysis:

Purpose, importance and necessity of the same, factors affecting, task work, daily output from different equipment/ productivity.

Unit-6: Tender:

Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price build-up: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management.

Unit-7: Introduction to Acts:

Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights.

Text/Reference Books:

1. Mankiw Gregory N. (2002), *Principles of Economics,* Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), *Managerial Economics,* Tata McGraw Hill
3. Pareek Saroj (2003), *Textbook of Business Economics,* Sunrise Publishers
4. M Chakravarty, Estimating, Costing Specifications & Valuation
5. Joy P K, Handbook of Construction Management, Macmillan
6. B.S. Patil, Building & Engineering Contracts
7. Relevant Indian Standard Specifications.
8. World Bank Approved Contract Documents.
9. FIDIC Contract Conditions.
10. Acts Related to Minimum Wages, Workmen’s Compensation, Contract, and Arbitration
11. Typical PWD Rate Analysis documents.
12. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016
13. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

Sixth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Open Elective	OECE-609-18	Remote Sensing and GIS	3	0	0	3

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Objectives

- To introduce the concepts of remote sensing, satellite image characteristics and its components.
- To expose the various remote sensing platforms and sensors and to introduce the concepts of GIS, GPS and GNSS.

Course Outcome

The course will enable the students understand:

- The characteristics of Remote sensing satellites and Applications of remote sensing.
- The GIS and its Data models.
- The Global Navigation Satellite System.

Content

Unit-I: Remote Sensing: Physics of remote sensing, Remote sensing satellites, and their data products, Sensors and orbital characteristics, Spectral reflectance curves, resolution and multi-concept, FCC

UNIT – II: Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Elements of interpretation, Land use and land cover classification system, Unsupervised and Supervised Classification, Applications of remote sensing

UNIT - III Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications

UNIT - IV Global Navigation Satellite System (GNSS), GPS, GLONASS, GALILEO, GPS: Space segment, Control segment, User segment, GPS satellite signals, Static, Kinematic and Differential GPS, GPS Applications

Text/Reference Books:

1. T M Lillesand et al: Remote Sensing & Image Interpretation
2. Higher Surveying by A M Chandra New Age International Publisher

3. Remote Sensing & GIS by B. Bhatta Oxford University Press
4. Introduction to GPS by A. E Rabbany Library of congress cataloging in Publication data
5. Geomatics Engineering - Modern Surveying, GPS, Astronomy, Photogrammetry, Remote Sensing & GIS by: Dr. Manoj K.Arora& Prof. R.C.Badjatia

Sixth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1		BMPD-601-18	**Mentoring and professional development**	-	-	2	0

Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:
- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)
1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)
1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B.
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

SYLLABUS FOR BASKET OF ELECTIVE COURSES

Track-1

Geotechnical Engineering

Sixth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses	PECE-602A-18	Foundation Engineering	3	1	0	4

Course Outcome: On completion of this course, the students will be able to
1 - Understand the methods of surface and subsoil exploration and to prepare investigation report.
2 - Estimate the stresses in soils and bearing capacity of soil for shallow foundation.
3 - Design various types of shallow foundation and to estimate settlement. 4
4 - Apply the concepts of deep foundation and solve problems related with pile foundation.

Unit-I :Soil Exploration
Object of soil investigation for new and existing structures. Depth of exploration for different structures. Spacing of bore Holes. Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance. Essential features and application of the following types of samples- Open Drive samples, Stationery piston sampler,. Rotary sampler,.- standard penetration test - static and dynamic cone penetration test ,Bore Hole log for S.P.T. Geophysical exploration by seismic and resistivity methods

Stresses Distribution: Bosussinesq equation for a point load, uniformly loaded circular and rectangular area,Newmark’s chart and its construction. 2:1 method of load distribution. Comparison of Bosussinesq and Westerguard analysis for a point load. Pressure Bulb and Isobar. Related Numerical Problems

Unit-II: Earth Pressure
Terms and symbols used for a retaining wall. Movement of all and the lateral earth pressure. Earth pressure at rest. Rankine states of plastic equilibrium, Ka and Kp for horizontal backfills. Rankine’s theory both for active and passive earth pressure for Cohesionless backfill with surcharge and fully submerged case. Cohesive backfill condition. Coulomb's method for cohesion less backfill. Merits and demerits of Ranking and Coulomb's theories, Culmann’s graphical construction (without surcharge load).

Unit-III: Shallow Foundation
Type of shallow foundations, Depth and factors affecting it.Definitionof ultimate bearing capacity, safe bearing capacity and allowable bearing capacity. Rankine’sanalysis and Terzaghi’s analysis.Types of Shear failures. Factors affecting bearing capacity. B.I.S.recommendations for shape, depth and inclination factors. Plate Load test and standard penetrationTest. Causes of settlement of structures, Comparison of immediate and consolidation settlement, calculation of settlement by Plate load Test and Static Cone penetration test data. Allowable settlement of various structures according to I.S. Code.

Unit-IV: Pile Foundations
Types and function of pile - factors influencing the selection of pile - carrying capacity of single pile in cohesionless and cohesive soil by static formula.Determination of point resistance and frictional resistance of a single pile by Static formulas. Piles in Clay, Safe load on a Friction and point Bearing pile- dynamic formulae

(Engineering News and Hileys) Types of pile driving hammers & their comparison.Limitations of pile driving formulae. Negative skin friction **-** Carrying capacity of Pile group **-** Pile load test Cyclic Pile Load Test, Separation of skin friction and point resistance using cyclic pile load test.

Pile in sand, Spacing of piles in a group, Factors affecting capacity of a pile group, Efficiency of pile group by converse – Labare formula and feeds formulas. Bearing capacity of a pile group in clay by block failure and individual action approach. Calculation of settlement of friction pile group in clay. Settlement of pile groups in sand, Negative skin friction. Related Numerical problems

Well foundations-shapes, depth of well foundations, components, factors affecting well foundation design, Scour Depth, construction procedure, sinking of wells, rectification of tilts and shifts, recommended values of tilts & shifts as per I.S.3955.

Text/Reference Books:

1. Soil Mechanics by Craig R.F., Chapman & Hall
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons
3. Soil Mech. & Foundation Engg, by K.R.Arora Standard *Publishers* Distributors
4. Geotechnical Engineering, by P. Purshotama Raj *Tata Mcgraw Hill*
5. Soil Mech. & Foundation Engg., by V.N.S.Murthy CBS *Publishers* & Distributors.
6. Principle of Geotechnical Engineering by B.M.Das Cengage Publisher
7. Basic and applied Soil Mechanics by Gopal Ranjan and A.S. R. Rao New Age International Publishers
8. Geotechnical Engineering by Gulati and Datta, Tata McGraw Hill
9. Problems in Soil mechanics and Foundation Engineering by B.P.Verma, Khanna Publishers.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE -602B-18	Ground Improvement Techniques	3#	1	0	4

UNIT I: Introduction
Role of ground improvement in foundation engineering– Geotechnical problems in alluvial, lateritic and black cotton soils, Methods of ground improvement Selection of suitable ground improvement techniques based on soil conditions.

UNIT II: Insitu densification of cohesion
less soils and consolidation of cohesive soils: Dynamic compaction Vibroflotation, Sand compaction piles and deep compaction. Consolidation: Preloading with sand drains, and fabric drains, Stone columns and Lime piles-installation techniques – simple design – relative merits of above methods and their limitations.

UNIT III: Soil improvement with the addition of materials
lime stabilization - lime column method - stabilization of soft clay or silt with lime - bearing capacity of lime treated soils – settlement of lime treated soils - improvement in slope stability - control methods - chemical grouting – commonly used chemicals - grouting systems - grouting operations - applications - compaction grouting - introduction - application and limitations - plant for preparing grouting materials - jet grouting – jet grouting process - geometry and properties of treated soils - applications - slab jacking - gravel - sand - stone columns

UNIT IV: Soil improvement using reinforcing elements
introduction to reinforced earth - load transfer mechanism and strength development - soil types and reinforced earth - anchored earth nailing reticulated micro piles - soil dowels - soil anchors - reinforced earth retaining walls.

UNIT V: Geotextiles
Behaviour of soils on reinforcing with geotextiles - effect on strength, bearing capacity, compaction and permeability - design aspects - slopes - clay embankments - retaining walls – pavements

Reference books:
1. Moseley, Text Book on Ground Improvement, Blackie Academic Professional, Chapman & Hall
2. Boweven R., Text Book on Grouting in Engineering Practice, Applied Science Publishers Ltd
3. Jewell R.A., Text Book on Soil Reinforcement with Geotextiles, CIRIA Special Publication, Thomas Telford
4. Van Impe W.E., Text Book On Soil Improvement Technique & Their Evolution, Balkema Publishers
5. Donald .H. Gray& Robbin B. Sotir, Text Book On Bio Technical & Soil Engineering Slope Stabilization, John Wiley
6. Rao G.V. & Rao G.V.S., Text Book On Engineering With Geotextiles, Tata McGraw Hill

7. Korener, Construction & Geotechnical Methods In Foundation Engineering, McGraw Hill
8. Shukla, S.K. and Yin, J.H. Fundamental of Geosynthetic Engineering, Taylor & Francis
9. Swamisaran, Reinforced Soil and its Engineering Application, New Age Publication
10. Gulati, S.K. and Datta, M., Geotechnical Engineering, TMH

Sixth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses#	PECE-602C-18	Advance Soil Mechanics	3#	1	0	4

Course Outcome: On completion of this course, the students will be able to:
1. Do earth dam design and stability analysis for all kind of drainage conditions
2. Do stability analysis of any kind of slope and its protection
3. Understand the earth pressure theories and able to calculate lateral earth pressure for different conditions
4. Evaluate depth of embedment for cantilever as well as anchored sheet piles.
5. Learn the concept of machine foundation

Unit-I

Drainage & Dewatering: Introduction, ditches and sumps, well point systems, shallow well system, deep well drainage, vacuum method, Electro-osmosis, consolidation by sand piles.

Drilled Piers and Caisson Foundations: Drilled piers-types, uses, bearing capacity, settlement, construction procedure. Caissons-Types, bearing capacity and settlement, construction procedure.

Unit-II

Braced Cuts Depth of unsupported vertical cut, sheeting and bracing for deep excavation, movements associated with sheeting and bracing, modes of failure of braced cuts, pressure distribution behind sheeting.

Cofferdams Introduction, types of cofferdams, design and lateral stability of braced cofferdams, design data for Cellular cofferdams, stability analysis of cellular cofferdams on soil and rock, interlocking stresses.

Unit -III

Cantilever Sheet Piles Purpose of sheet piles, cantilever sheet piles, depth of embedment in granular soils-rigorous method, simplified procedure, cantilever sheet pile penetrating clay.

Anchored Bulkheads Methods of design, free earth support method in cohesionless and cohesive soils, fixed earth support method in cohesionless soils.

Unit-IV

Basics of Machine Foundations Terminology, characteristics elements of vibratory systems, analysis of vibratory motions of single degree freedom system-undamped free vibrations, undamped forced vibrations, criteria for satisfactory action of a machine foundation, degrees of a freedom of a block foundation, Barken's soil spring constant, Barken's method of a determining natural frequency of a block foundation subjected to vertical oscillations.

Reference Books:

1 S.Prakash, Gopal Ranjan&S.Saran, Analysis and Design of Foundation and Retaining Structures, SaritaPrakashan Meerut, 1977.
2 Swami Saran, Analysis and Design of Sub Structures, IBH Oxford
3 Gopal Ranjan, ASR Rao, Basic and Applied Soil Mechanics, New Age Intetrnational (P) Ltd. Publishers-N.Delhi, Edition No. - 3 rd, 2016.
4 Shamsher Prakash, Soil Dynamic, McGraw Hill, 1981.
5 Teng, Foundation Design, Prentice Hall, Edition No. - 10th, 1984.
6 P.Purshotam Raj, Geotechnical Engg, Tata Mcgraw Hill, N.Delhi, Edition No.- I, 1995 7 DebashisMoitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016

Sixth Semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses#	PECE -602D-18	Geosynthetics Engineering	3#	1	0	4

Course Outcome: On completion of this course, the students will be able to:
1 Identify the functions of geosynthetics
2 Select the geosynthetic products
3 Identify the testing methods for geosynthetics
4 Design withgeosynthetic products

Contents

UNIT I:
Basic Description of Geosynthetics Historical Development, the Nomenclature, Function, Use Around the World, Applications, Development in India.

UNIT II:
Raw Materials – Their Durability and Ageing Raw Materials, Durability, Degrading Agencies, Polymers, Biological Resistance, Chemical Resistance, Weathering Resistance.

UNIT III:
Manufacturing Methods Fibers, Yarn, Nonwoven Geotextiles, Woven geotextiles, D.S.F. Fabrics.

UNIT IV:
Geogrids – Testing And Evaluation Factors Influencing Testing, Sampling, Physical Properties, Mechanical Properties under Uniaxial loading, Creep Testing.

UNIT V:
Erosion Control WithGeogrids: Wind Erosion, Rain Water Erosion, Erosion Control Measures, Placement of

Geogrid.

UNIT VI:
Bearing Capacity Improvement with Geogrids Advantages, Mechanism. Modes of Failure, Friction Coefficient, Experimental Studies.

UNIT VII
Application of Geosynthetics in Water Resources Projects Case Studies: Dharoidam, Hiran II Dam, Meda Creek Irrigation Scheme, Lining of Kakarapar Canal.

Reference Books:

1. Robert M. Koerner, Designing with Geosynthetics, Prentice-Hall
2. G.V. Rao & G.V.S. Raju, Engineering with Geosynthetics, Tata McGraw-Hill
3. DebashisMoitra, Geotechnical Engineering, Universities Press, Edition No. - I, 2016.

Sixth Semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses#	PECE-602E-18	Geo Environmental engineering	3#	1	0	4

UNIT I
Soil Contamination: Introduction to Geo environmental engineering, Development of environmental geotechnologysources, Environmental cyclesproduction and classification of waste, Waste Containment.
Contaminant's movements in soil, Contaminant transport in sub surface : advection, diffusion, dispersion, governing equations.

UNIT II
Groundwater contamination, Water quality standards, Sources of contamination, Hydro chemical behavior of contaminants - Trace metals - Trace nonmetals - Nitrogen, organic substances - Measurement of parameters - Velocity - Dispersivity - chemical partitioning

UNIT III
Remediation of contaminantsfrom soil and Ground water: contaminant transformation: sorption, biodegradation, ion exchange, precipitation: ex-situ and in-situ remediation – solidification, bio–remediation, soil washing, electro kinetics, soil heating, verification, bio venting, Ground water remediation – pump and treat, air spraying, reactive well.

UNIT IV

Solid waste disposal and stabilization: Hazardous waste control and storage system 3 mechanism of Stabilization, incineration, organic and inorganic stabilization reutilization of solid waste for soil improvement.

UNIT V

Engineered landfill: Site selection, dumping, Design of landfill: CNS layer, leachate and air collection units, Case studies. CPCB rules and regulations on waste handling and management - Criteria for selection of sites for waste disposal - Disposal techniques -Disposal systems for typical wastes.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE -602F-18	Rock Mechanics	3	1	0	4

Course Outcome: On completion of this course, the students will be able to:
1 Identify the problems associated with underground excavations
2 Classify the rock mass using the reference data
3 Understand the failure criteria of rock
4 Determine in-situ stresses from field test data

UNIT I: Introduction

Importance of rock mechanics, composition of rocks, geological and lithological classification of rocks, classification of rocks for engineering purposes, R.Q.D. method of classification of rocks. Theories of Brittle failure.

UNIT II: Laboratory Testing of Rocks
Various methods of obtaining rock cores, methods of sample preparation, methods of removing end friction of the rock samples. Compression testing machine, uniaxial compression strength of rock samples, methods of finding tensile strength-direct and indirect methods, Brazilian test, shear box test, triaxial shear test, punch shear test

UNIT III: In-situ Testing of Rocks
Field direct shear test on rock blocks, field triaxial strength, use of flat jacks, chamber test, plate load test, cable jacking test.

UNIT IV: Stress Evaluation in Field Stress-
relief technique(over coring), use of strain gauges, bore hole, deformation cell, photoelastic stress meter, stress measurement with flat jack. Hydraulics Fracturing Techniques.

UNIT V: Stabilization of Rocks
Rock bolting, principle of rock bolting, various types of rock bolts, application of rock bolting. Field testing of rock bolts and cable anchors.

UNIT VI: Elastic and Dynamic
Properties of Rocks Stress-strain behaviour dynamic properties, resonance method and ultra-sonic pulse method.

UNIT VII: Pressure on Roof of Tunnels
Trap door experiment, Terzaghi's theory, Bieraumer, kommerel, Protodyakanov theory.

UNIT VIII: Stress Around the Tunnels
Basic design and Principles of tunnels in rocks, design of pressure tunnels in rocks.

Reference Books
1 Lama,et.al Rock Mechanics, Vol.I,II,III,IV
2 Jaeger and Cook, Fundamentals of Rock Mechanics
3 Stagg & Zienkiewiez, Rock Mechanics
4 Obert & Duvell, Rock Mechanics & Design of Structures in Rocks
5 Jaeger, Rock Mechanics & Engineering
6 Schzy, Art of Tunneling

SYLLABUS FOR BASKET OF ELECTIVE COURSES

Track-1I

Structural Engineering

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE - 603A-18	Design of Concrete Structures	3#	1	0	4

Course outcomes: On completion of this course the students will be able:

1. To apply the loads on building frames and analyse them using direct and indirect methods.
2. To analyse the concrete components i.e. continuous beams, flat slabs, tanks and retaining walls, etc
3. To design and detail the concrete components i.e. curved beams, flat slabs, tanks and retaining walls, etc
4. To analyse and design the special foundations i.e. raft, pile and machine foundations.

Unit-I: Building frames:
Types, Analysis for vertical loads (Kani's method, Substitute frame method), Analysis for lateral loads (Portal and Cantilever), concept of redistribution of moments, design and detailing of various components (continuous beams and columns with uni or bi-axial bending)

Unit-II: Liquid retaining structures:
Introduction, Design criteria, Design of rectangular and circular concrete water tank resting on ground, Design of Intze tank, Staging for overhead tank.

Unit-III: Flat slabs:
Advantages and disadvantages of flat Slabs, basic action of Flat Slabs, Direct Design Method, Equivalent frame method, Codal provisions

Unit-IV: Design of special structures:
Retaining walls- cantilever and counter-fort type, curved beams (IS code method).

Unit-V: Foundations:
Design of raft foundation, pile foundation; Introduction to machine foundation, vibration characteristics, design consideration of foundation to rotary machine and impact machine.
 # Note: Design as per the relevant IS codes.

Reference Books:

1. Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education
2. Advanced Reinforced Concrete design; Varghese P C; PHI Pvt.Ltd.
3. Advanced Reinforced concrete design, Krishnaraju
4. Jain, A.K., Reinforced Concrete-Limit State Design, Nem Chand & Bros
5. Advanced RCC Design, SS Bhavikatti.
6. Design of concrete structures, B C Punmia
7. Prestressed concrete by Krishna Raju, TMH

BIS Codes of practice and Design Handbooks:

1. *IS 456-2000*- Indian Standard. Plain and Reinforced concrete -Code of practice
2. *IS 3370- Code of practice for concrete structures for storage of liquids
3. *IS1343-2012- Code of practice for Prestresed concrete
4. *Design Aid SP 16

Note: The codes marked with * are permitted in examination.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE-603B-18	Design of Steel Structures	3 #	1	0	4

Course outcomes: On completion of this course student will be able :
1. To apply the knowledge for analysis and design of various components of a plate girder.
2. To analyse , evaluate and design the different types of beam-column connections.
3. To design the column bases and footings for a steel structure under various loading conditions.
4. To analyse the loads and design various elements of industrial buildings.
5. To demonstrate the basic knowledge of plastic analysis of simple steel elements.

Unit-I: Design of Plate girders:
Elements of a plate girder, design of plate girder, curtailment of flanges, various type of stiffeners.

Unit-II: Beam-column connections:
Types of beam-column connections, Design of shear resistant connections - Design of bracket connections, seat connections and framed connections.

Unit-III: Column bases and footings
Types, slab base, gusseted base, bases for eccentrically loaded columns, Grillage footing.

Unit-IV: Industrial Buildings:
Types, elements of industrial buildings/sheds, structural planning, analysis and design of trussed roof/bents, crane/gantry girders, column brackets, transverse and longitudinal bracings.

Unit-V: Plastic analysis:

Introduction to Plastic analysis; plastic hinge mechanism, collapse load, analysis of simple beams and frames.

 # Note: Design procedure as per the relevant IS codes and guidelines.

Reference Books:

1. Limit state design of steel structures: S K Duggal, TMH
2. Design of steel structures (Vol. 2): Ram Chandra
3. Design of steel structures by BC Punmia
4. Design of steel structures, Vazirani and Ratwani
5. Planning of Industrial Structures, Dunham, C.W., John Wiley and Sons
6. Design of steel structures, Arya and Azmani.

BIS Codes of practice and Design Handbooks:

1) IS 800: 2007 (General construction in steel-Code of practice)*
2) IS 875-2015 Part -3 [Design loads (other than earthquake) for buildings and structures — code of practice- wind loads]*
3) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*

Note: The codes marked with * are permitted in examination.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**		
	Professional Core courses#	PECE-603C-18	Advanced Structural Analysis	3#	1		Professional Core courses#

Course Outcomes: On completion of this course students will be able:
1. To evaluate the indeterminacy of different types of building frames.
2. To develop and relate stiffness and flexibility matrices for beams and frames.
3. To analyse beams and fames using flexibility and stiffness matrix method.
4. To apply the concept of finite element method to basic civil engineering structures.

Unit-I: Analysis of building frames
Static and kinematic indeterminacies of rigid and pin-jointed frames, action and displacement equations, generalized system of coordinates, Kani's method, and other approximate methods-Portal, cantilever and substitute frame method.

Unit-II: Flexibility matrix method
Development of flexibility matrices for statically determinate and in determinate beams, rigid-jointed and pin-jointed plane frames using physical approach. Analysis of simple problems of beams and frames and its computer applications.

Unit-III: Stiffness matrix method
Relation between flexibility and stiffness matrices, transformation of element stiffness matrices to system stiffness matrix, development of stiffness matrices for statically determinate and indeterminate structures using physical and element approach, Analysis of simple problems of beams and frames and its computer applications

Unit-IV: Finite element method:
Review of principle of virtual work, Ritz method, Basic concept, elementary applications of principles and formulation of problems, the element characteristic matrix - element assembly
and solution for unknowns, basic equations of elasticity, strain displacement relations, steps of FEM, Basic element shape, Discretization process; Application of finite element method to one and two dimensional plane stress strain elements.

Unit-V: Model analysis:
Structural similitude, Direct and indirect model analysis, Model material and model making, Measurement for forces and deformations.

Reference Books:
1 Basic structural analysis - C.S. Reddy Tata McGraw-Hill
2. Intermediate structural analysis - C . K. Wang. McGraw Hill
3. Structural Analysis, Devdas Menon, Narosa Publishers.
4. Structural analysis- A matrix approach - GS Pandit and SP Gupta
5. Matrix analysis of framed structures - William weaver, Jr. James M. Gere
6. Finite element analysis - C.S. Krishnamurthy
7. Finite element methods - O.C. Zeincwicz

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	p	
	Professional Core courses#	PECE-603D-18	Structural Analysis and Design	3#	1	0	Professional Core courses#

Course Outcomes: On completion of this course the students will be able:
1. To understand and determine the indeterminacy of different types of structures.
2. To calculate forces and moments in indeterminate structures due to static as well as moving loads.
3. To analyse and design concrete structures i.e. column subjected to moments, foundations, retaining walls, etc.
4. To analyse and design the steel structures i.e. column bases, beam-column joints, plate girders and roof trusses.

Unit-I: Review of indeterminacy:
Static and kinematic indeterminacies of beams, rigid-jointed and pin-jointed plane frames.

Unit-II: Analysis of indeterminate structures:
Analysis indeterminate beams and frames by Kani's method, Theorem of three moments and other approximate methods- Portal, Cantilever and Substitute frame method.

Unit-III: Moving loads and influence lines:
Analysis of moving Loads for determinate beams, Influence lines for indeterminate beams, trusses and frames. Muller Breslau principle.

Unit-IV: Design of Concrete structures:
Columns with moments: Design of short columns with uni-axial and bi-axial bending; Design of Long columns, use of design charts; **Foundations**: Isolated and combined footing for columns; **Staircases**, Introduction, types and design; **Retaining walls -** Cantilever and Counter-forte type retaining wall.

Unit-V: Design of Steel Structures:
Column bases: Slab base, Gusseted base; **Beam-column connections:** bracket connections, seated and framed connections.; **Plate girders:** Elements of a plate girder, design of plate girder section, intermediate and bearing stiffeners, **Roof trusses:** Types, Design loads, design of members and joints.

Reference Books
1 Basic structural analysis - C.S. Reddy Tata McGraw-Hill
2. Intermediate structural analysis - C . K. Wang. McGraw Hill
3. Structural analysis - S Ramamurtham,
4. Reinforced Concrete Design; Pillai & Menon; Tata McGraw-Hill Education
5. Limit state Design of Reinforced Concrete; Varghese P C; PHI Pvt.Ltd.
6. Design of concrete structures, B C Punmia
7. Limit state design of steel structures: S K Duggal, TMH
8. Design of steel structures: N Subramanian, Oxford publications
9. Design of steel structures (by limit state method as per IS: 800-2007), S S Bhavikatti

BIS Codes of practice and Design Handbooks:

1. *IS 456-2000- Indian Standard. Plain and Reinforced concrete -Code of practice
2. *Design Aid SP 16.
4. *IS 800: 2007 (General construction in steel-Code of practice)
5.* IS 875-2015 Part -3 [Design loads (other than earthquake) for buildings and structures — code of practice- wind loads]
6. *SP: 6(1) (Handbook for structural engineers-Structural steel sections)

Note: The codes marked with * are permitted in examination.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Professional Core courses#	PECE-603E-18	Prestressed Concrete	3#	1	0	4

Course outcome: On completion of this course the student will be able to:
1. Recognize the materials for prestressed concrete and its properties, advantages and applications in contrast to normally reinforced concrete.
2. Comprehend the concept of pre-tensioning and post-tensioning of prestressed concrete, types of prestressed members, prestressing systems and its components.
3. Analyse the prestress, its losses, and determine the strength of a prestressed concrete sections using Indian Standards (IS) guidelines under flexure, shear and torsion.
4. Evaluate the strength and serviceability requirements of different prestresed concrete members i.e. beams, slab and anchor blocks.
5. Design the sections and the reinforcement for prestressed concrete beams, prestressed slabs and anchorage zones as per the IS specifications.

Unit-I: Materials for prestressed concrete
Introduction to prestressing concrete; High strength concrete- strength, creep and shrinkage, permissible stresses; High tensile prestressing steel –treatments, forms of prestressing steel, strength, relaxation of steel, permissible stresses.

Unit-II: Prestressing devices and systems
Types of prestressing, tensioning devices and equipments, pre-tensioning systems, post- tensioning systems (advantages and disadvantages, procedure, applications)

Unit-III: Analysis of prestress and bending stresses
Analysis of prestress, resultant stresses at a section, pressure line or thrust line concept and internal resisting couple, concept of load balancing, losses of prestress, deflection of beams.

Unit-IV: Strength of prestressed concrete sections
Types of flexural failure, strain compatibility method, IS:1343 code procedure for flexural strength, design for limit state of shear and torsion and codal provisions for detailing.

Unit-V: Design of prestressed concrete beams and slabs
Transfer of prestress in pre tensioned and post tensioned members, design of anchorage zone reinforcement, design of simple beams/gorders, cable profiles, design of slabs.

Reference Books

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill
2. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
3. P. Dayaratnam, Prestressed Concrete, Oxford & IBH
4. R. Rajagopalan, Prestressed Concrete.

BIS Codes of practice

1. * IS 1343 2012, Code of Practice for Prestressed Concrete
2. * IS 456-2000, Code of practice for design of reinforced concrete

Note: The codes marked with * are permitted in examination.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	P	
	Professional Core courses#	PECE-603F-18	Bridge Engineering	3#	1	0	4

Course Outcomes: On completion of this course the student will be able:
1. To evaluate the basic design considerations for different types of bridge structure.
2. To analyse the concrete and steel bridges as per the various loading standards of India.
3. To design the main structure of the concrete and steel bridges.
4. To design the various types sub-structure and bearings for a bridge.
5. To demonstrate the various construction and maintenance methods for a bridge structure.

Unit-I: Planning and General design consideration
Classification of bridges, Factors considered for planning of Concrete and Steel Bridges site selection; Design consideration - geometric and hydraulic considerations, optimum spans; Design aids and Codes of practice, loading standards for highway and railway bridges (IS, IRC, RDSO, AASHTO).

Unit-II: Concrete Bridges
Culverts; Slab, T-beam, box girder bridges, balanced cantilever bridge, arch bridge; Bridge deck and approach slabs - Slab design methods - bridge deck systems - Slab-beam systems - Box girder systems - Detailing of box girder systems. (not design), Special requirements for Prestressed Concrete bridges.

Unit-III: Steel Bridges
Plate girder bridge, truss bridge, suspension cable bridge, cable stayed bridge; Analysis and design of Truss bridge and plate girder bridge

Unit-IV: Substructures:
Design of Piers - Columns and towers; Caissons, pile and well foundations; abutments and retaining walls.

Unit-V: Bearings and expansion joints
Types and functions of bearings, design of elastomeric bearings, rocker and roller type bearings, general requirements for provisions of expansion joints.

Unit-VI: Construction techniques and maintenance
Construction techniques: Cast in-situ, Prefabricated, Incremental launching, Free cantilever construction, provisions for inspection and maintenance.

 # Note: Design as per the relevant IS, IRC codes and guidelines for bridges.

Reference Books
1. Krishna Raju N., “Design of Bridges”, 4th Edition, Oxford and IBH Publishing Co., Ltd., 2008
2. Ponnu Swamy, “Bridge Engineering”, 4th Edition, McGraw-Hill Publication, 2008.
3. Swami Saran, “Analysis and Design of sub-structures”,2nd Edition, Oxford IBH Publishing co ltd., 2006.
4. Vazirani, Ratvani & Aswani, “Design of Concrete Bridges”,5th Edition, Khanna Publishers,2006.
5. D.J. Victor, “Essentials of Bridge Engineering,” Oxford & IBH Publishing, New Delhi, 2001.

BIS Codes of practice and Design Handbooks:

1) IS 800: 2007 (General construction in steel-Code of practice)*
2) SP: 6(1) (Handbook for structural engineers-Structural steel sections)*
3) IS 456:2000 Code of practice for design of concrete structures*
3) Relevant IRC and IS guidelines for bridge design.

Note: The codes marked with * are permitted in examination.

SYLLABUS FOR BASKET OF ELECTIVE COURSES
Track-1II

Construction Engineering.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE-604A-18	Construction Equipment & Automation	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes

1. Understand Equipments & Automation and key features of its performance
2. Know automation systems in detail, including its evolution, objectives, criteria, levels of benefits, and shortcomings
3. Know a series of case studies representing diverse project types, sizes, certification levels, and climate regions
4. Know what are innovations in construction equipments

Content

UNIT-I : Construction Equipment

Introduction, significance of equipment in construction industry - laboratory setting including plan reading, specification reading, construction scheduling and estimating, Job layout and its importance. Study of equipments with reference to available types and their types and their capacities, factors affecting their performance.

UNIT – II: Construction Equipment Management

Equipment Management- Introduction, Differences between men and manpower, Extent of Mechanisation, Equipment planning, Selection of equipment, Forward planning, Purchase of Equipment, Specifications for ordering equipment

Unit –III: Equipment for Earthwork

Fundamentals of Earth Work Operations - Earth Moving Operations - Types–Excavation equipment- Power Shovels, Back Hoe, Drag line, Clamshell – Scrapers, Bull Dozers, Tractors, Hauling Equipment – Dump trucks, Dumpers Loaders, trucks, Earth Compaction Equipment-Tamping Rollers, Smooth Wheel Rollers, Sheepsfoot Roller, Pneumatic-tyred Roller, Vibrating Compactors, Vibrocompaction methods.

UNIT-IV: Other Construction Equipment

:Pile driving Equipment - Erection Equipment – Cranes, Derrick Cranes, Mobile cranes, Overhead cranes, Traveller cranes, Tower cranes - Types of pumps used in Construction - Grouting - Material Handling Conveyors –Industrial Trucks, Forklifts and related equipment.

Unit-V : Equipment for Concrete and Road laying

Aggregate production equipment- Different Crushers – Feeders - Screening Equipment -Handling Equipment - Batching and Aggregate Mixing Equipment - Asphalt Plant, AsphaltPavers, Asphalt compacting Equipment – Ready mix concrete equipment, Concrete mixers,Concrete batching and mixing plant, Transportation of concrete mix, Concrete pouring and pumps, concrete compaction equipment.

UNIT-VI: Automation:

Introduction & Technical terms of Automation and robotics; advantages & disadvantages,Need for construction automation, Applications, Automation in precast construction industry, Autonomous Machines on the Construction Site, Drones to Survey Working Areas , Robotics in Concrete Works, IoT Sensors to Collect and Process Data, Virtual Reality During Project Planning and Training **,** Automatic Concrete Screeding Machine, Concrete Surface Finishing Robot, Automation in High Rise Building Construction, Automation in prefabrication of masonry and on site masonry construction, partially automated masonry element prefabrication, automated manufacture of brick wall masonry blocks, Automation in timber construction, Automation in production of steel components, Transformable welding robot.

Reference Books

1 Peurifoy, R.L., Ledbetter, W.B. and Schexnayder, C., "Construction Planning, Equipment and Methods", McGraw Hill, Singapore, 2006.
2. Sharma S.C. "Construction Equipment and Management", Khanna Publishers, New Delhi, 1988.
3. Deodhar, S.V. "Construction Equipment and Job Planning", Khanna Publishers, New Delhi, 1988.
4. Dr.MaheshVarma, "Construction Equipment and its planning and Application", Metropolitan Book Company, New Delhi. 1983.

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Professional Core courses#	PECE-604B-18	Sustainable Construction Methods	3#	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Course Outcomes:

1. Create new engineering materials to improve the performance of infrastructure
2. Characterize and mitigate natural and man-made hazards
3. Improve fundamental knowledge of the inter-relationships between the built environment and natural systems.
4. Develop the technological innovations needed to safeguard, improve, and economize infrastructure

Content

UNIT-I : INTRODUCTION

Definitions- Various types - Pillars of Sustainability - Circle of Sustainability - Need - systems and their sustainability - Green Buildings -Difference between Green and Sustainability - Climate Change, Global warming - National and International policies and Regulations. Identification of cutting edge sustainable construction materials, technologies, and project management strategies for use in the construction industry and evaluation of their potential to reduce the negative environmental impacts of construction activity.

UNIT – II: BUILDING CONSTRUCTION METHODS

Conventional vs modular construction methods, development , Engineering principles, benefits**,** Modular construction methods for repetitive works, Green Roofs, Cool Roofs, Passive House, Rammed Earth Brick**,** Passive Solar, Greywater Plumbing Systems, Solar Thermal Cladding, Solar Power, Water Efficiency Technologies, Sustainable Indoor Environment Technologies.

UNIT **–III: PRECAST CONSTRUCTION METHODS**

Modular construction methods for repetitive works; Precast concrete construction methods; Benefits , Sustainability in Concrete Mix Design, Greener, Faster and Sustainable Construction Practices Through Precast Solutions, Use of secondary cementitious material (SCM's) like GGBS, fly ash, ultra-fine GGBS in the production of the concrete, Basics of Slip forming for tall structures, Structural 3D Printing, Self-healing Concrete**,** Green Insulation, Sustainable Resource Sourcing, Environmental Sustainability Benefits From Precast Concrete.

UNIT-IV: CONSTRUCTION METHODS OF BRIDGES

Types of foundations and construction methods; Basics of Formwork and Staging; Proactive Maintenance**,** Prefabrication/Modular Construction, balance between environment and construction activities, reducing problems at site with minimal staging, increasing safety etc, Constructions are sustainable with reduced use of natural resources, Costs of Construction/Assembly and Transportation, Lifespan, Environmental Impact, harmful emissions during bridge construction, Reducing waste, solar panels to power LED lights to illuminate its deck, water-powered light system powered by the currents of the river, development that meets the needs of the present.

UNIT-V: NEW CONSTRUCTION MATERIALS TECHNOLOGIES Introduction to new construction materials & technologies, Synthetic Roof Underlayment, Electro chromic Glass, Biodegradable Materials, Reduction of water consumption, Impact on environment, Concepts of climate responsive building,

Sustainability assessment using standard approaches- LEED/GRIHA rating evaluation process

Text/Reference Books

1. Margaret Robertson, Sustainability Principles and Practice, Routledge, 2014

2. Martin A. A. Abraham , Sustainability Science and Engineering: Defining Principles, Elsevier Science, 2005

3. Tony Clayton, Nicholas J. Radcliffe, Anthony M. H. Clayton, Sustainability: A Systems Approach, Routledge, 1996

4. Stephen M. Stephen, Stephen M. Wheeler, Climate Change and Social Ecology: A New Perspective on the Climate Challenge, Routledge, 2012

5. Gursharan Singh Kainth, Climate Change, Sustainable Development and India, LAP Lambert Academic Publishing, 2011

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE-604C-18	Repair and Rehabilitation **of Structures**	3#	1	0	4

Objectives:-

To understand the knowledge on quality of concrete, durability aspects, causes of deterioration, repairing of structures and demolition procedures.

Course Outcomes After studying this course, students will be able to

1. Understand the cause of deterioration of concrete structures.
2. Able to assess the damage for different types of structure.
3. Summarize the principles of repair and rehabilitation of structures.
4. Recognize the ideal material for different repair and retrofitting techniques.

Content

Unit-I: Introduction to Rehabilitation of Structures

Aging of Structures, Performance of Structures, Need for rehabilitation of structural members, Maintenance, Facets of Maintenance, Importance of Maintenance, Various aspects of Inspection, Assessment procedure for evaluating a damaged structure, Causes of deterioration.

Unit-II: Evaluation and Deterioration of Concrete Buildings

Visual Integration, Destructive Testing Systems, Non Destructive Testing Techniques, Semi Destructive Testing Techniques, Chemical Testing, Embedded Metal Corrosion, Disintegration Mechanisms, Moisture Effects, Thermal effects, Structural effects, Faulty construction, Distress in structure due to corrosion, fire, leakage, earthquake and effects, case studies, damage assessment and evaluation models.

Unit III: Strength and Durability of Concrete

Quality assurance for concrete – Strength, Durability and Thermal properties of concrete – Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness and cracking, Methods of corrosion protection, Corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection, Special concretes -- Polymer concrete, Sulphur infiltrated concrete, Fibre reinforced concrete, High strength concrete, High performance concrete, Vacuum concrete, Self-compacting concrete, Geopolymer concrete, Reactive powder concrete, Concrete made with industrial wastes.

Unit IV: Surface Repair and Retrofitting
Strategy and Design, Selection of Repair Materials, Surface Preparation, Bonding Repair Materials to existing concrete, Placement methods, Epoxy bonded replacement concrete, Preplaced aggregate concrete, Shotcrete/Gunite, Grouting, Injection Grouting, Micro concrete, Mortar repair for cracks, shoring and underpinning.

Unit V: Strengthening Techniques and Seismic Rehabilitation
Beam Shear capacity Strengthening, Shear Transfer Strengthening between members, Column Strengthening, Flexural Strengthening and Crack Stabilization, Seismic strengthening of structures, Guidelines for Seismic Rehabilitation, Seismic Vulnerability and Strategies for Seismic Retrofit.

Reference's Books
1. R.T. Allen and SC Edwards, "Repair of Concrete Structures", Blakie and Sons, 1987
2. FEMA273, NEHRP Guidelines for Seismic Rehabilitation of Buildings, 1997
3. DovKominetzky.M.S., "Design and Construction Failures", Galgotia Publications Pvt. Ltd., 2001
4. Emmons, P.H., "Concrete Repair and Maintenance", Galgotia Publication,2001
5. Ravishankar.K, Krishnamoorthy.T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
6. Malhotra, V.M. and Carino, N.J., " Handbook on Non Destructive Testing of Concrete", CRC press, 2004
7. Bohni, H., "Corrosion in Concrete Structures", CRC Press., 2005
8. ShettyM.S., "Concrete Technology – Theory and Practice", S.Chand and Company, 2008.
9. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
10. P.C. Varghese , "Maintenance Repair and Rehabilitation and Minor Works of Bridges", PHI learning Pvt.Ltd, 2014.

Sixth Semester

S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses#	PECE-604D-18	Construction Cost Analysis **Methods**	3	1	0	4

Course Outcomes: Student shall be able to
1. To Prepare Capital budgeting of a Construction site.
2. To Prepare a Performance statement of a company'
3. To estimate various financial instrumental such as IRR, Break even analysis
4. To prepare a Job Cost report of a Construction Site.

Unit-I: Project Appraisal
Project appraisal, government and private project evaluators, significance of social benefit – cost analysis, commercial profitability, national economic profitability, measurement of direct and indirect benefit and costs. Calculation of benefit cost ratio.

Unit-II : Engineering economics
Time value of money, discounted cash flow, decision making among the alternatives, replacement analysis, break even analysis.
Project capital: Cash flow of a project, estimation of minimum capital required, internal rate of return (IRR), Multiple IRR, estimation of annualized cost.

Unit-III: Depreciation
Importance, classification, types – straight line, sum of year method, double rate declining balance method.
Capital Budgeting: Element of budgeting – men, materials, equipment, overhead, profits – preparation of capital budget.

Unit-IV: Cost Control:
Understanding control, operating cycles, cost account codes, Job cost report, Projected Cost Estimates, status reporting, variance and earned value.

Unit-V: Performance statement
Capital gearing ratio, shares, debentures, PBT, PAT, PBIT, Earning per share, preparation of company's performance statement, Inflation.

REFERRENCE BOOKS:

1. M Pandey, Financial Management, Vikas Publishing house pvt ltd9th Edition.
2. Donald Newnan, Engineering Economics analysis, Oxford University Press
3. R Panneerselvam, Engineering Economics, PHI Learning Pvt. Ltd.
4.Frank Harris & Ronald Mc CafferModern Construction ManagementBlackwell science4th Edition.
5. Roy PilcherPrinciples of Construction Management, Mc Graw Hill London.
6. United Nations Guidelines for Project Evaluation Oxford & IBH Publishing Co. Pvt. Ltd.
7. A.H. Taylor & H Shearing, Financial & Cost Accounting for Management Mac Donald & Evans

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Professional Core courses#	PECE-604E-18	Contract Management	3	1	0	4

Course Outcomes:

To make Civil Engineering students able to analyze, evaluate and design construction contract documents.

UNIT I: Construction Contract:
Terminology, Importance, Agreement, Contract, essential conditions, Elements, nature, Features, Suitability. Subcontracts and supply contracts, Indian Contracts Act. Types of contract: Lump sum contract, Item rate contract, Cost plus fixed fee contract, Cost plus percentage contract, Special contracts.
Execution of Works: Direct execution by Department, Muster Roll, Piece work Agreement, Work Order.

UNIT II: Construction Specifications
Standard specifications, general specification, development, interpretation. Tender and tender documents: tender form, Types of bidding, tender notice, tendering procedure, submission and opening of tender.

UNIT III: Contract document
Design of Contract Documents –Contract document: Drafting of clauses, development, and interpretation, CPWD conditions of contract, FIDIC conditions of contract. International Contract Document, Standard Contract Document.

UNIT IV: Construction claims
Extra item, excess quantity, deficit quantity, price escalation. Dispute resolution mechanism: litigation, arbitration, conciliation, mediation, dispute resolution board. Contractual Problems: Possible contractual problems, creation of claims, development of disputes.
BOT contract: Types of contract, PPP framework, types of risk, concession agreement, drafting of clauses, development, and interpretation.

UNIT V: Legal requirements
Labour Laws, Child Labour Act, Sales Tax, VAT, Service Tax, Excise Duty, Laws relating to Wages, Bonus and Industrial

Disputes, Labour Administration, Insurance and Bonding, Insurance and Safety Regulations.

REFERRENCE BOOKS:

1. L.S. Ranaga Rao Contract Management and Dispute Resolutions Engineering staff College of India January 2008.
2. C. J. Schexnayder and R. E. Mayo,Construction Management Fundamentals,McGraw Hill, New Delhi.2003
3. General Conditions of Contract,Central Public Works Department, New Delhi,2010
4. S. Ranaga Rao,Contract Management & Dispute Resolutions,Engineering staff College of India,January 2008
5. D.S. Berrie and B.c. Paulson,Professional construction management including C.M.,Design construct and general contracting,McGraw Hill InternationaL,Third Edition 1992..
6. V. K. Raina,Construction & Contract Management Practices,SPD, New Delhi

Sixth Semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
	Professional Core courses#	PECE-604F-18	Construction Engineering Materials	3	1	0	4

Course Outcomes: On completion of this course the student will be able

•To Provides a broad understanding of the composition, microstructure, and engineering behavior of various materials used in civil engineering applications.
•To Introduces various modifications possibilities in construction materials.
•To Understand and Explain Special Concrete.

Unit-I: Construction Materials

Classifications of Construction Materials. Consideration of physical, Mechanical, thermo-physical Properties, characteristics behaviour under stress, Selection criteria for construction materials, green building materials.

Unit-II: Materials for making Mortar and concrete

Lime manufacture, properties, hardening of lime, types of lime, lime concrete uses. Cement, pozzolanic material, aggregates, water, admixtures - characteristics, properties and uses .Types of mortars, special mortars,their properties and applications. Ceramic Materials: Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application.

Unit-III: Polymers in civil engineering

Rubber and plastics, properties, effect of temperature on mechanical properties. Uses and application.Polymers, fibres and composites, Fibre reinforced plastic. Architectural use and aesthetics of composites. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

Unit IV: Metals
Types of structural steels, special steel, alloy steel, stainless steel, light gauge steel, Corrosion of concrete and reinforcing steel in various environments. Electro-chemical process and measures of protection during construction. Ferro-cement, composition and properties.

Unit V: Modified Materials
Modified bitumen using plastic or polymers, Modified cement concrete using various industrial ashes, soil stabilised using slag, polymers - their properties, advantages and applications as per Indian conditions.

Unit-VI: Special concretes
Concretes, Behaviour of concretes – Properties and Advantages of High Strength and High Performance Concrete – Properties and Applications of Fibre Reinforced Concrete, Self- compacting concrete, Alternate Materials to concrete on high performance & high Strength concrete.

REFERENCES BOOKS:

1. Rangawala S.C. Engineering Materials Chortor Publications 1991.
2. S.K. Duggal Building Materials, New Age International Publications 2006.
3. Bruntley L.R Building Materials Technology Structural Performance & Environmental Impact McGraw Hill Inc 1995.
4. R Chudley Construction Technology, Vol I - IV Longman Group Construction Ltd. 1973.

Mandatory Course

Sixth Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
	Mandatory Course (Non Credit)	BTMC-101-18	Constitution of India	3	0	0	S/US

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

Course content

- Meaning of the constitution law and constitutionalism
- Historical perspective of the Constitution of India
- Salient features and characteristics of the Constitution of India
- Scheme of the fundamental rights
- The scheme of the Fundamental Duties and its legal status
- The Directive Principles of State Policy - Its importance and implementation
- Federal structure and distribution of legislative and financial powers between the Union and thn States
- Parliamentary Form of Government in India - The constitution powers and status of the President of India
- Amendment of the Constitutional Powers and Procedure
- The historical perspectives of the constitutional amendments in India
- Emergency Provisions : National Emergency, President Rule, Financial Emergency
- Local Self Government - Constitutional Scheme in India
- Scheme of the Fundamental Right to Equality
- Scheme of the Fundamental Right to certain Freedom under Article 19
- Scope of the Right to Life and Personal Liberty under Article 21

7th & 8th Semester Syllabus

B. Tech Civil Engineering

SYLLABUS FOR BASKET OF ELECTIVE COURSE

Track-1V

Transportation Engineering

Seventh/Eight Semester							
S. No.	Category	Code	Course Title	Hours per week			Credits
				L	T	P	
1	Professional Core courses	PECE -701A-18	**Pavement and geometric design of Highways**	3	1	0	4

Course Outcome: On the completion of this course the student will be able to

1. Understand patterns of Traffic and its behaviour.
2. Develop an understanding for various sight distances and its affects
3. Analyse and design Horizontal and vertical curves
4. Design the cross-sectional elements for different types of highways.
5. Develop and appreciate the concept of intersections

Suggest the required facilities for pedestrians, bicycles, buses and parking

Unit 1 : Introduction to Design Elements: Objectives and requirements of highway geometric design, Sight distances - types, analysis, PIEV theory, factors affecting, measurements, Horizontal alignment – design considerations, stability at curves, super-elevation, widening, transition curves; curvature at intersections, vertical alignment - grades, ramps, design of summit and valley curves, combination of vertical and horizontal alignment including design of hair pin bends, IRC standards and guidelines for design problems.

Unit 2 : Cross Section Elements: Right of way and width considerations, roadway, shoulders, kerbs traffic barriers, medians, frontage roads; Facilities for pedestrians, bicycles, buses and trucks, Pavement surface characteristics - types, cross slope, skid resistance, unevenness.

Unit 3 : Design of Intersections: Types of Intersections; Design Principles for Intersections; Design of At-grade Intersections –Channelization, Objectives; Traffic Islands and Design standards; Rotary Intersection – Concept, Advantages and Disadvantages; Grade separated Interchanges – Types, warrants and Design standards.

Unit 4: Miscellaneous Elements: Traffic Signs and Markings. Requirements of Pedestrians; Pedestrian facilities on Urban Roads; Cycle Tracks – Guidelines and Design standards; Bus bays –Types and Guide lines; Design of On-street and Off-street Parking facilities – Guidelines for lay out Design,

Books Recommended:

1. Khanna S.K. and C.E.G. Justo, "**Highway Engineering"**, Nemchand Bros(2012).
2. Kadyali L. R.; "**Highway Engineering"**, Nem Chand & Brothers, Roorkee (2004).
3. Rao G. V.; "**Transportation Engineering**", Tata McGraw Hill Publisher, New Delhi (1999).
4. Yoder E. J.; "**Principles of Pavement Design",** John Wiley & Sons (1975).

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
2	Professional Core courses	PECE -701B-18	**Airport planning and Design**	3	1	0	4

Course outcome: On the completion of this course the student will be able to

1. Understand the detail concepts of the airport engineering.
2. Able to design runway, taxiway and apron pavements.
3. Suggest the runway orientation and the runway length as per FAA & ICAO guidelines.
4. Conceptualise Pavement management system for maintenance

Unit 1. Airport Engineering: Components of airport: Classifications of obstructions, Imaginary surfaces, Approach zone and turning zone. Runway orientation, basic runway length, corrections for elevation, temperature & gradient, airport classification.

Unit 2. Runway & Taxiway Design: Wind-rose diagram, Geometric design of runway, airport capacity, factors controlling taxiway layout, geometric design standards for taxiway holding aprons,

Unit 3. Structural design of runway pavements LCN/PCN method of rigid pavement design, different LCN/PCN of aircrafts using runway. Pavement Evaluation for runway & taxiway, design of overlay, Terminal area, building area, parking area, apron, hanger typical airport layouts.

Unit 4. Design of flexible and rigid runways as per FAA procedure, Specifications for the different layers of runway and taxiway pavements, Pavement management systems for runway pavements. Benkelman Beam method for maintenance.

Books Recommended:

1. Khanna, Arora & Jain, **Airport Planning and Design**, Nem Chand & Brothers, Roorkee (1999).
2. Rangwala, **Airport Engineering**, Charotar Publishing House (2019).
3. Horenjeff Robert, **Airport Engineering**, McGraw Hill International Publisher (2010).

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
3	Professional Core courses	PECE -701C-18	**Intelligent Transportation systems**	3	1	0	4

Course outcome: On the completion of this course the student will be able to:

1. Understand the concept of Intelligent Transportation system.
2. Analyse ITS's relevance with Smart growth and energy based planning.
3. Conceptualise the urban transportation systems using different models.
4. Explore methodology for smart city based Transit planning
5. Suggest road safety using ITS.

Unit 1. Overview of Intelligent Transportation Systems: Introduction to ITS, its history and future, Framework for analysing ITS relationships- Information technology, GPS.

Unit 2. Advanced Transportation Planning Process and Problems: Terminology of Transportation Planning, Functional Components, Brief Overview of Models used in Transportation Planning, Environmental concerns, Smart growth and sustainable alternatives, Energy based planning, Global Positioning Systems. Transportation System Impacts: Travel Facilities, Origin and Destination, Transit Surveys, Decision making Process, Transportation Demand Management (TDM). Use of GIS in Transport planning.

Unit 3. Land Use Transportation System: Urban system components, Urban Spatial Structure, Location Theory, Land use planning, Land use Models, Land use transport models – (Lowry and Garin), Lowry Models, Transit Oriented Development(TOD).

Unit 4. Urban Public Transportation: Urban Growth and Public Transport needs, Transit mode characteristics, transit characteristics, Fleet size and capacity estimation, Smart cities based Transit Planning.
Road Safety: Highway safety using ITS.

Books recommended:

1) Joseph M. Sussman, Perspectives on Intelligent Transportation systems

2) Kadyali, Traffic Engineering and Transport planning, Khanna publishers

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
4	Professional Core courses	PECE -701D18	**Highway Construction and Management**	3	1	0	4

Course outcome: On the completion of this course the student will be able to:

1. Understand various materials and techniques used to construct pavements.
2. Design the bituminous pavement as per standards.
3. Design thickness and joints including drainage of concrete pavements.
4. Suggest maintenance of pavement.
5. Conceptualise pavement management systems.

Unit 1. Bituminous pavement: Various types of bituminous constructions and their selection, Construction of earth, gravel, water bound macadam, surface dressing, premixed carpet, bituminous macadam, bituminous concrete, mastic asphalt, cement concrete pavements.
Design of bituminous mixes: Requirement of bitumen mixes, design of bituminous mixes as per Marshall Stability & flow method, I.R.C & MORTH recommendations for the design mix of various layers of flexible pavements.

Unit 2. Concrete pavement: Components of concrete pavement-PQC**,** various joints**-** construction joints, longitudinal joints, transverse joint, thermal joints, tie bars, dowels; Construction techniques**-** alternate bay method, continuous bay method, expansion joint and strip method; slip form paving.
Drainage: Introduction, Importance & Principles of Highway Drainage, Surface Drainage, Sub Surface drainage.

Unit 3. Highway Maintenance: Introduction, Maintenance of Earth, gravel, WBM Roads, Bituminous Roads, Cement Concrete pavements. Use of Benkelman Beam method, Falling weight deflector-meter.

Unit 4. Pavement Management Systems: Concepts of Pavement life cycle, Pavement performance assessment, evaluation of pavement structural capacity and safety, combined measures of pavement quality, development of models for pavement deterioration, rehabilitation and maintenance strategies.

Books recommended:

1. Khanna S.K. and C.E.G. Justo, “Highway Engineering”, Nemchand Bros, (2002)
2. Kadyali L. R.; Highway Engineering, Nem Chand & Brothers, Roorkee(2002)
3. Haas R.C.G., Hudson W. Ronald., Zaniewski John P., Modern Pavement Management, Krieger Publishing Company, 1994.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
5	Professional Core courses	PECE -701E-18	**High Speed Rail Engineering**	3	1	0	4

Course Objective: On the completion of this course the student will be able to:

1. Develop an understanding for high-speed Rails.
2. Outline the requirements for design.
3. Design of points, crossing and turnouts.
4. Suggest techniques to mechanize tracks,
5. Analyse signals inter locking devices for high-speed rails.

Unit 1. High Speed Railway(HSR) Engineering: Introduction, Key elements of HSR technology, History and Development of HSR: world and India, High Speed Trains: Present & Future.

Unit 2. Feasibility Studies: Basic traffic and volume feasibility studies related to HSR, Design requirements and construction of aspects of high- speed rail (HSR) passenger transport systems engineering. Geotechnical and structural requirements for track, bridges, viaducts and tunnels.

Unit 3. Geometric design: Alignment, horizontal curves, super elevation, equilibrium, cant and cant deficiency, length of transition curve, gradients and grade compensation. Stations and yards, and their classification.
Points and crossings: introduction, necessity of points and crossings, turnouts, points and crossings, design of a simple turnout.

Unit 4. Track Recording: Requirements for track system, Basic design and construction of HSR stations and rolling stock maintenance facilities. Equipment, Mechanized Maintenance
Basic Signalling and interlocking: objects of signalling, engineering principle of signaling, classification of signalling, control of train movements, interlocking definition, necessity and function of interlocking, methods of interlocking, mechanical devices for inter locking. Traction and tractive resistance, stresses in track, modernization of railway track.

Books Recommended:

1. Arora and Saxena, **Railway Engineering**, Dhanpat Rai & Sons, New Delhi (2006)
2. Rangawala, **Railway Engineering**, Charotar Publishing House, Anan (1989).
3. Aggarwal M.M., and Satish Chandra **Railway Engineering**, Oxford University Press (2002).

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
6	Professional Core courses	PECE -701F -18	**Traffic Engineering and Management**	3	1	0	4

Course Outcomes: On the completion of this course the student will be able to:
1. Understand the traffic flow parameters and measures related to traffic control and management.
2. Analyze the feasibility of different control devices for traffic management.
3. Create the solution of the problem related to traffic congestion and safety.
4. Outline the causes of road accidents and procedure to assess the road safety audit.
5. Apply the methods to identify the black spots and propose the solutions to improve road safety.
6. Assess the need of modernization in traffic management and road safety.

Unit 1. Fundamentals of Traffic Management: Principles of Traffic management; Highway capacity and Level of service; Mixed Traffic flow: PCU concept and its limitations; Traffic stream parameters: Interrupted and Uninterrupted flow

Unit 2. Traffic Regulation and Control: Road Signs and markings; Channelization; At-grade and Grade separated intersections; Traffic Rotary;
Design principles of traffic signals

Traffic Management techniques: Regulatory measures for Traffic management; Travel Demand Management; Role of ITS in traffic management.

Unit 3. Road accidents: Causes of road accidents: Vehicle design factors & Driver characteristics influencing road safety, Road condition, Parking and its influence on traffic safety.

Road safety measures: Accident data collection methods; Representation of accident data: Collision and condition diagram; Methods to Identify and Prioritize Black spots; Road safety: 3 E measures.

Unit 4. Road safety audits: Key elements in Road safety audit; Road safety audit procedure and investigations; Role of ITS in Road safety.

Books Recommended:

1. Fred L. Mannering, Scott S. Washburn. Principles of Highway Engineering and Traffic Analysis.7th Edition, Wiley, 2019.
2. Kadiyali, L. R., "**Traffic Engineering and Transport Planning"**, Khanna Publishers
3. Chakroborty Partha and Animesh Das, "**Principles of Transportation Engineering"**, Prentice hall
4. O'Flaherty C A**, "Transport Planning and Traffic Engineering",** Butterworth Heinemann, Elsevier, Burlington, MA

SYLLABUS FOR BASKET OF ELECTIVE COURSE

Track-V

Environment Engineering

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
1	Professional Core courses#	PECE-702A-18	**Environmental Law and Policy**	3#	1	0	4

Unit 1

Basic Concepts in Environmental Law. An introduction to the legal system; Constitution, Acts, Rules, Regulations; Indian Judiciary, Doctrine of precedents, judicial review, Writ petitions, PIL–liberalization of the rule of locus standi, Judicial activism. Introduction to environmental laws in India; Constitutional provisions, Bhopal gas tragedy; Rio conference. General principles in Environmental law: Precautionary principle; Polluter pays principle; Sustainable development; Public trust doctrine. Overview of legislations and basic concepts.

Unit 2

Forest, Wildlife and Biodiversity related laws Evolution and Jurisprudence of Forest and Wildlife laws; Colonial forest policies; Forest policies after independence 2 Statutory frame work on Forests, Wildlife and Biodiversity: IFA, 1927; WLPA, 1972; FCA, 1980; Biological Diversity Act, 2002; Forest Rights Act, 2006. Strategies for conservation–Project Tiger, Elephant, Rhino, Module leopard.

Unit 3

Air, Water and Marine Laws National Water Policy and some state policies Laws relating to prevention of pollution, access and management of water and institutional mechanism: Water Act, 1974; Water Cess Act, 1977, EPA, 1986. Pollution Control Boards Ground water and law Judicial remedies and procedures Marine laws of India; Coastal zone regulations. Legal framework on Air pollution: Air Act,1981; EPA, 1986

Unit 4

Environment protection laws and large Projects Legal framework on environment protection-Environment Protection Act as the framework legislation–strength and weaknesses; EIA; National Green tribunal The courts infrastructure projects

Unit 5

Hazardous Substances and Activities Legal framework: EPA and rules made thereunder; PLI Act, 199 Principles of strict and absolute liability

Reference Books:

1. Birnie P. (2009) et al., International Law and the Environment, 3rd ed., Oxford.
2. Desai A. (2002) Environmental Jurisprudence, 2nd ed., Modern Law House, Allahabad.

3. Gadgil M. and Guha R. (1995) Ecology and Equity, Oxford, New Delhi.
4. Gadgil M. and Guha R. (1997) This Fissured Land, Oxford, New Delhi.
5. Guha R. (2000) Environmentalism: A Global History, Oxford, New Delhi.
6. Kamala S. and Singh U.K. (eds.) (2008) Towards Legal Literacy: An Introduction to Law in India, Oxford, New Delhi.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
2	Professional Core courses#	PECE-702B-18	**Rural water Supply And onsite Sanitation Systems**	3#	1	0	4

Syllabus Content:

Unit 1

Rural Water Supply: Issues of rural water supply –Various techniques for rural water supply- merits-National rural drinking water program- rural water quality monitoring and surveillance- operation and maintenance of rural water supplies

Unit 2

Low Cost Water Treatment: Introduction – Epidemiological aspects of water quality- methods for low cost water treatment-Specific contaminant removal systems

Unit 3

Rural Sanitation: Introduction to rural sanitation-Community and sanitary latrines-planning of wastewater collection system in rural areas- Ecological sanitation approach – Grey water and storm water management- Compact and simple wastewater treatment systems in rural areas-catch basins-constructed wetlands- roughing filters- stabilization ponds - septic tanks – anaerobic baffled reactors-soak pits- low cost excreta disposal systems- Village ponds as sustainable wastewater treatment system-Wastewater disposal

Unit 4

Solid Waste Management: Disposal of Solid Wastes- Composting- land filling- incineration- Biogas plants- Other specific issues and problems encountered in rural sanitation.

ReferenceBooks:

1. Eulers,V.M.,andSteel,E.W.,MunicipalandRuralSanitation,6thEd.,McGrawHillBookCompany,.
2. Wright, F.B.,Rural water Supply and Sanitation,E.Robert Krieger Publishing Company,Huntington,NewYork.
3. Juuti, P., Tapio S. K.,and Vuorinen H.,Environmental History of Water: Global Viewson Community Water Supply and Sanitation, IWA Publishing(IntlWaterAssoc).
4. Winbald,U.,andSimpson-Hebert,M.,EcologicalSanitation,SEI,Stockholm,Sweden.
5. Kadlec R.H.andWallace S.D.,TreatmentWetlands, CRCPress, BocaRaton
6. WastewaterEngineering–TreatmentandReuse,MetcalfandEddy,TataMcGrawHill

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
3	Professional Core courses#	PECE-702C-18	**Air and Water Quality Modeling**	3#	1	0	4

UNIT I
Modeling Concepts : Casual and statistical models-Characteristics- Steps in model development - Importance of model building.- conservation of mass and mass balance –calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles.

UNIT 2
Water Quality Modeling: Water quality models – Historical development – Mass balance equation – Streeter - Phelps Equation – Modification to Streeter – Phelps Equation – Waste load allocations – Dissolved oxygen in Rivers and estuaries; Lake Water Quality Models; Models for Nitrogen, Bacteria, Phosphate and toxicants - Ground Water Quality Modeling -Contaminant solute transport equation, Numerical methods.

UNIT 3
Air Pollution Modeling: Chemistry of air Pollutants - Atmospheric reactions, sinks for air pollution –Transport of air Pollutants - Meteorological settling for dispersal of air pollutants– Vertical structure of temperature and stability, atmospheric motions, Wind and shear, self-cleaning of atmosphere; transport and diffusion of stack emissions – atmospheric characteristics significant to transport and diffusion of stack emission – stack plume characteristics.

UNIT 4
Water Quality Index: Categories of water quality index. Determination of water quality index (WQI): Industrial and municipal effluent index, ambient water quality index, combined water quality index and Delphi method.

UNIT 5
Air Quality Index: Categories of air quality index. Determination of air quality index (AQI): National AQI, Extreme value indices, Regional indices.

Reference Books:
1. Steven C. Chapra, Surface Water Quality Modeling, Tata McGraw-Hill Companies,Inc., New Delhi, 1997.
2. J.L. Schnoor, Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York, 1996.
3. Arthur C. Stern, Air Pollution, Air Pollutants, their transformation and Transport,(Ed.), (Third Ed.) Volume I , Academic Press, 2006.
4. Deaton and Wine Brake, Dynamic Modeling of Environmental Systems, Wiley &Sons, 2002
5. E.V. Thomson, Principles of Surface Water Quality Modeling and Control, Happer and Row Publishers New York, 1987.
6. M.D. Palmer, Water Quality Modeling, the World Bank Washington DC.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
4	Professional Core courses#	PECE-702D-18	**Solid and Hazardous Waste Management**	3	1	0	4

Unit-1

Introduction: Definition of solid wastes and hazardous wastes, Nuisance potential and extent of solid waste problems, Objectives and scope of integrated solid waste management. **Collection, Storage and Transportation of Wastes:** Types of collection systems and their components, Concept of waste segregation at source and recycling and reuse of wastes.

Unit-2.

Solid Waste Processing and Treatment: Waste processing – processing technologies – biological and chemical conversion technologies–Composting-thermal conversion technologies-energy recovery.

Unit-3

Hazardous Waste Treatment and Disposal: Biological and chemical treatment of hazardous wastes; Solidification and stabilization of wastes; Incineration for the treatment and disposal of hazardous wastes; Land farming; Landfill disposal of hazardous waste; Bioremediation of hazardous waste disposal sites.

Unit-4

Sanitary Landfills: Design, development, operation and closure of landfills, Management of leachate and landfill gases, environmental monitoring of landfill sites.

Unit-5

Legal Requirements: Municipal solid waste rules; Hazardous waste rules; Biomedical waste rules; E-waste rules; Rules related to recycled plastics, used batteries, flyash, etc.

Reference Books:

1. Pichtel,J.,WasteManagementPractices–Municipal,HazardousandIndustrial,CRCPress
2. Vesilind, P.A., Solid Waste Engineering, Thomson Learning Inc.

3. Tchobanoglous,G.,Vigil,S.A.andTheisen,H.,IntegratedSolidWasteManagement:EngineeringPrinciplesand Management Issues, McGraw Hill
4. HowardS.Peavy,DonaldR.Rowe&GeorgeTchobanoglous,“EnvironmentalEngg.”,McGrawHill
5. CPHEEO,*ManualonMunicipalSolidwastemanagement*,*CentralPublicHealthand Environmental Engineering Organization*, Government of India

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
5	Professional Course Courses	PECE-702E-18	**EIA and LCA**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Unit1

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Public Hearing, Decision Making, Monitoring the Clearance Conditions, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000),List of projects requiring Environmental clearance.

Unit2

Key Elements of an Initial Project Description and Scoping, Project Location(s), Risks to Environment and Human Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues. Criteria for the selection of EIA methodology, impact identification ,impact measurement, impact interpretation & Evaluation, Methods - Adhoc methods, Checklists methods, Matrices methods, Networks methods,

Unit3

Introduction: Life Cycle Assessment concepts, A brief history of Life-cycle Inventory analysis, overview of methodology, three components, identifying and setting boundaries for life-cycle stages, issues that apply to all stages, Applications of inventory analysis.

Unit 4

Procedural framework of Life-cycle inventory: Introduction, define the purpose and scope of inventory. General issues in Inventory analysis: Introduction, Using Templates, Data issues, special case boundary issues. Product design evaluation and analysis using LCA

Reference/TextBooks:

- Sadler,B.andMc Cabe M.,“Environmental Impact Assessment: Training Resource Manual”,UNEP (2002).
- Wathern.P.,“Environmental Impact Assessment-Theory and Practice”,Routledge Publishers, London(2004).
- Rau J.G.and Wooten D.C.,“Environmental Impact Analysis Handbook”, TataMc Graw Hill (1980).
- CanterR.L.,“Environmental Impact Assessment”,Tata McGraw-Hill (1981).

- Ciambrone D.F.,"Environmental Life Cycle Analysis",CRCPress (1997).

Ralph E Horne,Tim Grant,VergheeK,"Life Cycle Assessment: Principles, Practice and Prospects", CSIRO Publishers(2009).

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
6	Professional Course Courses	PECE-702F-18	**Sustainable Engg and Technologie**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Unit-1

Introduction:

Sustainability - Introduction, Need and concept of sustainability, Social-environmental and economic sustainability concepts. Sustainable development, Nexus between Technology and Sustainable development, Challenges for Sustainable Development. Multilateral environmental agreements

Unit-2

Global Environmental Issue:

Resource degradation, Climate change, Regional and Local Environmental Issues. Carbon credits and carbon trading, carbon foot print Carbon sequestration – Carbon capture and storage (CCS). Environmental management standards, ISO 14000 series, Life Cycle Analysis (LCA) - Scope and Goal, Bio-mimicking and Protocols

Unit-3

Sustainable Design:

Basic concepts of sustainable habitat, Green buildings, green materials for building construction, material selection for sustainable design, green building certification- GRIHA & IGBC Certification for buildings, Energy efficient building design

Unit-4

Clean Technology and Energy

Energy sources: Basic concepts-Conventional and non-conventional, solar energy, Fuel cells, Wind energy, Small hydro plants, biofuels, Energy derived from oceans, Geothermal energy, Rainwater harvesting.

Unit-5

Green Engineering:

Green Engineering concepts, Sustainable Urbanization, industrialization and poverty reduction; Social and technological change, Industrial Processes: Material selection, Pollution Prevention, Industrial Ecology, Industrial symbiosis.

Text Books:

1. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.

2. Bradley. A.S; Adebayo,A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning

Reference Books:

1. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication

2. ECBC Code 2007, Bureau of Energy Efficiency, New Delhi Bureau of Energy Efficiency Publications-Rating System, TERI Publications - GRIHA Rating System

3. Ni bin Chang, Systems Analysis for Sustainable Engineering: Theory and Applications, McGraw-Hill Professional.

SYLLABUS FOR BASKET OF ELECTIVE COURSE

Track-VI

Water Resources

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
1	Professional Course Courses	PECE-703A-18	Design of Hydraulic Structures	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Content

Unit 1:Design of Storage Structures – Planning and investigations of reservoir and damsite, choice of dams, Analysis and Design of dams: Gravity dams, Earthen dams, rockfill dams, buttress dams. Spillway and Non-overflow sections and their design, Types of spillways, Flow characteristics of gated/ungated spillways. Types of energy dissipators Influence of tail water rating curve on choice of energy Dissipater, Backwater curve analysis for reservoirs.

Unit 2: Diversion Structures- Barrages and weirs on permeable foundations, Design of different types of weirs: Sharp crested weirs, broad crested weirs. Barrage components: Glacis, Rigid apron, Flexible (concrete block) apron, Design consideration of barrages for surface and sub-surface flows,causes of failure, Bligh's and Lane's creep theory,Khosla's theory and method of independent variables, standard profiles, corrections, exit gradient, plotting of HGL, Design of d/s and u/s protection works, length of pucca concrete floor.

Unit 3: Canal Structures- Head regulator, Cross regulator and Falls, Canal section design (unlined and lined); in cutting and filling, Aqueducts; Super passage; Syphon Aqueducts, Distribution structures for conveying water from canals to irrigation fields, Canal capacity determination from field water requirements. Design considerations for cross drainage works: hydraulic structures, including spillways, stilling basins, and embankment seepage; Design of canal falls, Canal Outlets, Essential requirements, classifications, criteria for outlet behaviours, flexibility, proportionality, sensitivity, sensitiveness, Fluming the canal. Design of Channel Transition, Operation and maintenance of canals.

Text/Reference Books

1. David A. Chin (2013), "water-Resources Engineering", PEARSON.
2. Edward Kuiper "Water Resources Development", Springer
3. Novak, P., Moffat, A.I.B., Nalluri, C. and Narayanan, R. Hydraulic Structures Unwin Hyman Ltd., London 1989.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
2	Professional Course Courses	PECE-703B-18	River Engineering	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Content

Unit 1: Introduction to River Engineering- River classifications, Primary functions of rivers, Rivers in India, Himalaya andPeninsular.River flow kinematics

Flow resistance in rivers- Physical properties of sediments, sediment movement in rivers, shear stress, shields diagram, scouring around bridge piers and embankments,Bed load and suspended load transport for uniform and non-uniform bed material, Total load equations, sediment sampling, Reservoir sedimentation, river flow and sediment-duration curves.

Unit 2: River Hydrology- River morphology:thresholds in river morphology, steady river flow, steady non-uniform river flow, river continuity equations, river momentum equations, River gauging, river flood waves, river flood routing.

River Mechanics- River Equilibrium: particle stability, Stability of Channel, regime relations, river bend equilibrium, downstream hydraulic geometry, meander plan form, geomorphic analysis of river channel responses; Fundamentals of alluvial channel flows, bars in alluvial rivers, Lateral river migration, River dynamics: degradation and aggradation of river bed,River Confluences and branches, River Database.

Unit 3: River Stabilization- River bank stability, Riverbank riprap revetment, river bank protection, Principles of stabilisation and rectification of rivers, River bank stability analysis, Design of river training works like Revetments, Dikesgroynes, guide banks, gabions, Hydraulic modelling of rivers,Diversion and Cofferdams; River regulations systems;

Dredging and Disposal, River restoration

Unit 4: River Models- dimensional model studies for rivers, rigid bed models, mobile bed river models, finite difference approximations, one-dimensional and multi-dimensional river models.

Text/Reference Books

1. Garde, R.J., (2006), "*River Morphology*", New Age International Publishers
2. Garde, R.J. and Ranga Raju, K.G., (2006), "*Mechanics of Sediment Transportation and Alluvial Stream Problems*", Wiley Eastern Limited
3. Julien, Pierre, Y., (2002), "*River Mechanics*", Cambridge University Press
4. Mechanics of Sediment transportation and Alluvial stream problem by R.J. Garde and K.G RangaRaju – New Age Int. Publications.
5. Sahnaz Tigrek and Tuce Aras "Reservoir Sediments Management", CRC Press

Seventh/Eight Semester

S. No.	Category	Code	Course Title	Hours			Credits
				L	T	P	
3	Professional Course Courses	PECE-703C-18	**Ground Water**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Content

Unit 1: Introduction- Groundwater in Hydrologic Cycle, Occurrence of groundwater, Hydrogeology, Hydrometeorology, Groundwater Systems, Planning and Management of Groundwater, Groundwater Sustainability, Groundwater protection: Concerns and Acts

Groundwater Properties- Vertical distribution of subsurface, characteristics and classification of aquifers, Determination of specific yield and permeability.Physical properties of groundwater and aquifers, principles and fundamental equations of porous media flow and mass transport, well hydraulics and pumping test analysis, role of groundwater in the hydrologic cycle, groundwater quality and contamination groundwater hydrology, well hydraulics and well construction, geo-physical explorations, Different types and procedures for analysis of geophysical studies, groundwater quality and management of groundwater resources

Unit 2: Groundwater Hydraulics- Groundwater movement: Darcy's law and its limitations, Dupuit–Forchheimer Theory of Free-Surface Flow, Stream lines and Flow net analysis, Discharge and draw down for various condition of groundwater flow, Groundwater tracers, continuity equation, equation of motion in ground water,

Well hydraulics- steady/unsteady, uniform/radial flow to a well in a confined/unconfined/leaky aquifer, Well flow near aquifer boundaries/for special conditions, Evaluation of well loss parameters, Partial penetration of wells, Interference of wells, Collector wells and Infiltration galleries.Well Hydraulics: Steady and unsteady radial flows in aquifers; partially penetrating wells; multiple well systems; characteristic well losses; specific capacity, Surface and Subsurface investigations (Geologic methods; remote sensing; geophysical explorations; electrical resistivity and seismic refraction), Water Wells: design, Construction; completion, development, protection and rehabilitation of wells;

Unit 3: Groundwater Quality- Groundwater constituents and contaminants, Water quality standards, Groundwater solubility, Disequilibrium and Saturation Index, sources of groundwater contamination, Mass Transport of Dissolved Contaminants.Groundwater Management: Basin management, investigations, conjunctive use, modelling, artificial recharge; Saline water intrusion

Unit 4: Impact of Climate change – Climate change impact on hydrological cycle, Climate change impact on Groundwater, impact on groundwater quality, climate change simulation, impact on availability of water in aquifer.

Text/Reference Books

1. Groundwater Hydrology by Todd, D. K. and Mays, L. W., John Wiley & Sons, Inc.
2. Ground and Surface Water Hydrology by Mays, L. W., John Wiley & Sons, Inc.
3. Bear J., Hydraulics of Groundwater, McGraw-Hill, New York, 1979.
4. Bouwer H., Groundwater Hydrology, McGraw-Hill, New York, 1978.
5. Driscoll, Groundwater and Wells, Johnson Filtration Systems, Inc., 1986.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
4	Professional Course Courses	PECE-703D-18	**Hydraulic Modelling**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Content

Unit 1: Computational Methods- Basics of Hydraulic Modelling (similarity mechanics, model laws, distinction between numerical and hydraulic models, classification of hydraulic modelling, materials used in the model, scale effect, design, construction, operation and interpretation of the results), applications of computational methods for pipe flow, flow through porous media.

Unit 2: Groundwater Modelling-Role of instrumentation and data processing; Gravity dominated models (modelling of energy dissipaters, overflow spillways, siphon spillways, bridge piers, vortex formation, cavitation, flow induced vibrations); Gravity friction models: (pumped flow models, ship models, surge tank models); Friction dominated models; River models with fixed and mobile bed; Basin and reservoir models; Tidal models with fixed and mobile bed; estuarine models; harbor and breakwater models, models of offshore structures; Hybrid and Analogue models; Scope and limitations of hydraulic modelling, complementary aspects of numerical and hydraulic modellingGeophysical Subsurface Explorations, Well Hydraulics- Image well theory. Groundwater Modelling, Artificial Recharge of Groundwater, Groundwater Quality Modelling, contaminant transport model, Soil moisture simulation models.

***Water Supply Networks*:** Design and optimization of water distribution system- trial error method, cost-head loss ratio method. Optimization using linear programming techniques, surge analysis in water distribution system,Hybrid and Analogue models; Scope and limitations of hydraulic modelling, complementary aspects of numerical and hydraulic modelling.

Unit 3: RS and GIS: Ideal Remote Sensing System, Spectral Signatures of Earth features, Principles of Interpretation, Use of Remote Sensing and GIS in Water Quality Modelling, vegetation mapping, runoff modelling, Drought and Flood Monitoring, water resource mapping.

Unit 4: Simulation Software in Water Resources:Introduction to Surface water models (HMS) - Storm Water Management Models (SWMM) -Water CAD, STORM CAD - Ground Water Flow models - Visual Modflow.

Text/Reference Books

1. Schilling, R.J., and S.L. Harris, (2007), *"Applied Numerical Methods for Engineering*", CENGAGE Learning, India Edition.
2. Abbot, M.A. and Vervey (1996), *"Computational Hydraulics",* Elsevier Publications.
3. Domenico (1972), "Concepts and Models in Groundwater Hydrology", McGraw Hill Inc. N York
4. Anderson M.P., and Woessner W.W., Applied Groundwater Modelling : Simulation of flow and advective transport, Academic Press, Inc., 1992
5. Lynn E. Johnson, (2008), "*Geographical Information Systems in Water Resources Engineering*" CRC Press.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
5	Professional Course Courses	PECE-703E-18	**Transient in Closed Conduits**	3	1	0	4

External Marks: 60, Internal Marks: 40, Total Marks: 100

Content

Unit 1: Transient Flow Equations- Wave propagations, wave reflection and transmission, Reynold Transport Theorem, Continuity equation, momentum equation, wave velocity, solution of governing equations, Unsteady friction, basic water hammer equations, causes of transient in closed conduits.Analysis of flow in water transmission and water distribution systems (pump & gravity); optimal design and operation of systems for achieving different goals (including latest tools available for optimization); Extended period simulations, Software for WDN analysis and design,

Unit 2: Causes of Transients- Transients caused by opening and closing of valves, Transient caused by power failure of pumps.Rehabilitation of pipeline systems; Water auditing, online monitoring and control, leak and burst detection; transient analysis and surge protection; Appurtenances (valves / flow meters etc.); Selection of pipe material; Jointing details; Pipe laying and testing; Structural design for buried and surface mounted pipes unsteady flow in pipes (water hammer) and designing for surge protection**;** Differential equations for unsteady pipe flow.

Unit 3: Transient Control- Surge Tanks: Types of surge tanks, analysis of surge tanks, governing equations, solution of governing equations, surge oscillations in frictionless system, stability of tanks, design considerations. Air Chamber, Valves, Optimal transient control.transients in penstocks of hydro-electric schemes; analysis for transient control using surge tanks; air chambers; air valves; pressure regulating valves etc.; Emphasis should be on development of computer programs for transient analysis; awareness about commercially available software for transient analysis

Text/Reference Books

1. Chaudhry, H., Applied hydraulic transients, Springer, New York.
2. Hydraulic Transients by Streeter, V.L. and Wylie, E.B., McGraw Hill, New York.
3. Watters, G.Z, *Analysis and control of pipe flow in pipes*, Butter Worth Publishers, 1984.
4. Design of Irrigation Structures by R.K. Sharma, Oxford IBH Pub

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
6	Professional Course Courses	PECE-703F-18	**Urban Hydrology and Hydraulics**	3	1	0	4
External Marks: 60, Internal Marks: 40, Total Marks: 100							

Content

Unit 1: Introduction- Trends of Urbanization and Industrialization, Urban water supply demand forecast, urban hydrological cycle.

Unit 2: Urban water Management- Rain water harvesting, managed aquifer recharge, effect of water management practices on urban water infrastructure, hydrology and ground water regime, mapping of water supply and sewage networks.

Urban water Infrastructure- water supply, sanitation, sewerage and wastewater conveyance infrastructures, Water supply and sewerage network hydraulics, Structural safety and mitigating plans against natural and human caused threats.

Unit 3: Urban Storm water- Master drainage plans, Estimation of urban stormwater quantity, Wastewater collection systems, Design of storm sewer network systems, Storage facilities. Interaction between urban drainage and solid waste management, Stormwater Management, Operation and maintenance of urban drainage system.

Unit 4: Sustainable Design- Sustainable urban designs, Methodologies for assessing sustainability of urban water infrastructures, Emerging sustainable materials and design procedures for water supply and sewerage pipelines,determination of design flow; runoff for highways, airports, and urban areas; design of drainage gutters, channels, sewer networks, and culverts.

Text/Reference Books

1. Geiger, W.F., Marsalek, J. Zudima and Rawls, G.J (1987), *"Manual on Drainage in Urban Areas", 2 Volumes*, UNESCO, Paris.
2. Wanielista, M.P., and Yousef, Y.A. (1993), *"Storm water Management"* John Wiley and Sons, Inc., New York.
3. Hall, M.J., (1984), *"Urban Hydrology*", Elsevier Applied Science Publishers.
4. Mays, L.W., Hydraulic Design Handbook, McGraw-Hill, 1999

SYLLABUS FOR
Open Elective

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Open Elective	OECE-701-18	**Metro Systems and Engineering**	3	0	0	3

Syllabus Content:

PART-A

Introduction toMetro systems

Overview of Metro Systems; Need for Metros; Routing studies; Basic Planning and Financials.

Planning and Development

Overview and construction methods for: Elevated and underground Stations; Viaduct spansandbridges;Undergroundtunnels;Depots;CommercialandServicebuildings.InitialSurveys&Investigations;

Traffic Management Systems

Basics of Construction Planning &Management, Construction Quality& Safety Systems. Traffic integration, multimodal transfers and pedestrian facilities; Environmental and social safeguards; Track systems-permanent way.Facilities Management Module

PARTB

Signalling Systems

Introduction to Signalling systems; Automatic fare collection; Operation Control Centre(OCCand BCC);SCADA and other control systems; Platform Screen Doors.

Electrical Systems

OHE, Traction Power; Substations-TSSandASS;PowerSCADA;StandbyandBack-upsystems;Greenbuildings, Carbon credits and clear air mechanics.

Mechanical Systems
Ventilation systems; Air conditioning for stations and buildings;Fire control systems; Lifts and Escalators

TextBooks:

1. "ElectricTractionforRailwayTrains:ABookforStudents,ElectricalandMechanicalEngineers, Superintendents of Motive Power and Others"Edward Parris BurchPalala Press2018.
2. "Metropolitan Railways: Rapid Transit in America (Railroads Past and Present)",Middleton,IndianaUniversityPress2013.
3. "WorldMetroSystems",Garbutt,CapitalTransportPublishing;2ndRevisededition1997.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
2	Open Elective	OECE-702-18	**Traffic Management**	3	0	0	3

Unit-1 :Fundamentals of Traffic Management

Principles of Traffic management; Highway capacity and Level of service; Mixed Traffic flow: PCU concept and its limitations; Traffic stream parameters: Interrupted and Uninterrupted flow

Unit-2:Traffic Regulation and Control devices

Road Signs and markings; Channelization;At-grade and Grade separated intersections; TrafficRotary; Design principles of traffic signals

Unit-3: Traffic Management techniques

Regulatory measures for Traffic management; Travel Demand Management; Role of ITS in traffic management

Unit-4 : Logistics for Traffic Management

Definition, domain, role and responsibility of traffic management agencies, Principles and systems of coordination in Traffic management; Intelligent transport system- concept, Traffic Management logistics - equipment's, vehicles and traffic control centre; Centralized Data Processing and Monitoring, Traffic personnel- skills & deployment systems.

TextBooks:

1. FredL.Mannering,ScottS.Washburn.PrinciplesofHighwayEngineeringandTrafficAnalysis.7thEdition, Wiley, 2019.
2. Kadiyali L.R.TrafficEngineering&TransportPlanning.KhannaPublications,2013.
3. KhistyC.J.andLallB.K.TransportationEngineering–AnIntroduction.3rdEdition,Pearson,2017.
4. KhannaS.K.,JustoC.E.GandVeeraragavanA.HighwayEngineering.Revised10thEdition,NemChand & Bros, 2017.

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
3	Open Elective	OECE-703-18	**Road Safety**	3	0	0	3

UNIT 1. Road Accidents

Causes of road accidents: Vehicle design factors &Driver characteristic s influencing road safety, Road condition, Parking and its influence on traffic safety

UNIT2. Road safety measures

Accident data collection methods; Representation of accident data: Collision and condition diagram; Methods to Identify and Prioritize Blackspots;Roadsafety:3„E"measures

UNIT3. Road safety audits

Key elements in Road safety audit; Road safety audit procedure and investigations; Role of ITS in Road safety

UNIT4. Ensuring Traffic Safety in Road Operation:-Ensuring Traffic Safety during Repair and Maintenance, Prevention of Slipperiness and Influence of Pavement Smoothness, Restriction speeds on Roads, Safety of Pedestrians, Cycle Paths, Informing Drivers on Road Conditions with Aid of Signs, Traffic Control Lines & Guide Posts, Guardrails & Barriers and Road Lighting.

REFERENCE BOOKS: 1. BABKOV, V.F. `Road conditions and Traffic Safety', MIR, publications,Mascow - 1975.
2. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.
3. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications, New Delhi, 2009.
4. C. JotinKishty& B. Kent Lall, "Transportation Engineering-An Introduction" , Thrid Edition, Prentice Hall of India Private Limited, New Delhi, 2006
5. Latest Editions of Relevant Indian Roads Congress (IRC) Publications for Design of Roads and Road Safety.
6. Khanna and Justo, 'Text book of Highway Engineering', Nemchand Brothers, Roorkee,2001

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
4	Open Elective	OECE-704-18	**Environmental Impact** Assessment	3	0	0	3

Course objectives

1. To learn the concept and methodology of EIA and its documentation
2. Understand the different steps within environmental impact assessment

Course outcomes

1. Knowledge about EIA tools & methodologies and identify the suitable methodology and prepare Rapid EIA.
2. Be able to access different case studies/examples of EIA in practice

Unit-1: Evolution of EIA; EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping criteria; Practical applications of EIA

Unit-2: Legislative and environmental clearance procedures in India and other countries, Siting criteria; CRZ; Socio Culture and Public participation; Resettlement and rehabilitation.

Unit-3: EIA methodologies; Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment; Environmental management plan; Post project monitoring, EIA report and EIS; Review process.

Unit-4: Case studies on project, regional and sectoral EIA. Specialised areas like environmental health impact assessment; Environmental risk analysis; Economic valuation methods; Cost-benefit analysis; Expert system and GIS applications; Uncertainties.

Text/Reference Books:

1. Canter L. Environmental Impact Assessment, McGraw Hill.

2. Kiely G. Environmental Engineering, Tata McGraw Hill.
3. Rau G.J. and Wooten C.D. Environmental Impact Analysis Handbook, McGraw Hill.
4. Munn R.E. Environmental Impact Assessment, John Wiley & Sons.
5. Dhameja S.K. Environmental Engineering and Management, S. K. Kataria& Sons.MoEF Guidelines and amendments as updated onhttp://moef.gov.in

Seventh/Eight Semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
5	Open Elective	OECE-705-18	**Construction Materials**	3	0	0	3

Course Outcomes: On completion of this course the student will be able

•To Provides a brief description about different types of materials used in building construction for members like foundation, masonry, arches, lintels, balcony, roof, floor, doors, windows, stairs, plastering, painting and other general topics. Properties of various construction materials, their uses and different applications are discussed in this subject.

Unit-I: Introduction to building construction and basic building components (Foundation, plinth, wall, sill, lintel, roof, doors, windows, ventilators, staircases, sunshades etc.) along with the building materials., Role of materials in construction, Classifications of Construction Materials, green building materials.

Unit-II: Physical and chemical properties of Cement ,Lime and Supplementary Cementation materials , CC blocks, Fly ash Bricks, pozzolanic material, aggregates, water, admixtures - characteristics, properties and uses, Mortars, Ceramic Materials: Classification, Refractories, glass-(Toughened Glass, DU Glass, Security Glass), glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application.

Unit-III: Rubber and plastics, properties, Polymers, fibres and composites, Fibre reinforced plastic. Water Proofing Material. Adhesives and sealants. Structural elastomeric bearings and resilient seating. Polymer foams, Aluminium Composite Panels (ACP), WPC (Wood Plastic Composite, UPVC (Unplasticized Polyvinyl

Chloride), Charcoal fibres.

Unit IV: Timber and its uses (Plywood, Block board, HPL- High Pressure Laminates, Laminates etc.) Metals in construction (Aluminium Alloys, Steel, Ferrous Metals, Copper etc.)

References books:

1. Rangawala S.C. Engineering Materials Chortor Publications 1991.
2. S.K. Duggal Building Materials, New Age International Publications 2006.
3. Bruntley L.R Building Materials Technology Structural Performance & Environmental Impact McGraw Hill Inc 1995.
4. R Chudley Construction Technology, Vol I - IV Longman Group Construction Ltd. 1973
5. Neptel& Various Sites on Internet

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per**			**Credits**
				L	**T**	**P**	
6	Professional Core courses	HSMC -255	**Professional Practice, Law & Ethics**	2	0	0	2

Basic elements of civil engineering professional practice are introduced in this course. Rolesof all participants in the process-owners, developers, designers, consultants, architects, contractors, and suppliers - are described. Basic concepts in professional practice, business management, public policy, leadership, and professional licensure are introduced. The coursecovers professional relations, civic responsibilities, and ethical obligations for engineering practice. The course also describes contracts management, and various legal aspects related to engineering. Further, the course familiarizes students with elementary knowledge of laws that would be of utility in their profession, including several new areas of law such as IPR, ADR.

The course is designed to address the following:

- To make the students understand the types of roles they are expected to play in the
- society as practitioners of the civil engineering profession
- To develop some ideas of the legal and practical aspects of their profession

UNIT 1.Professional Ethics – Definition of Ethics, Professional Ethics, Business Ethics, Corporate Ethics, Engineering Ethics, Personal Ethics; Code of Ethics as defined in thewebsite of Institution of Engineers (India); Profession, Professionalism, Professional Responsibility, Professional Ethics; Conflict of Interest, Gift Vs Bribery, Environmental breaches, Negligence, Deficiencies in state-of-the-art; Vigil Mechanism, Whistleblowing, protected disclosures.

UNIT2:***General Principles of Contracts Management: Indian Contract Act, 1972 and amendments***covering General principles of contracting; Contract Formation & Law; Privacyof contract; Various types of contract and their features; Valid & Voidable Contracts; Primeand sub-contracts; Joint Ventures & Consortium; Complex contract terminology; Tenders ,Request For Proposals, Bids & Proposals; Bid Evaluation; Contract Conditions &Specifications; Critical /"Red Flag" conditions; Contract award & Notice To Proceed;Variations & Changes in Contracts; Differing site conditions; Cost escalation; Delays,Suspensions & Terminations; Time extensions & Force Majeure; Delay Analysis; Liquidated damages & Penalties; Insurance & Taxation; Performance and Excusable Non-performance;Contract documentation; Contract Notices; Wrong practices in contracting (Bid shopping,Bid fixing, Cartels); Reverse auction; Case Studies; Build-Own-Operate & variations; Public-Private Partnerships; International Commercial Terms;

UNIT 3 ***:Arbitration, Conciliation and ADR (Alternative Dispute Resolution) system:*** Arbitration – meaning, scope and types – distinction between laws of 1940 and 1996;UNCITRAL model law – Arbitration and expert determination; Extent of judicialintervention; International commercial arbitration; Arbitration agreements – essential andkinds, validity, reference and interim measures by court; Arbitration tribunal – appointment,challenge, jurisdiction of arbitral tribunal, powers, grounds of challenge, procedure and courtassistance; Award including Form and content, Grounds for setting aside an award,Enforcement, Appeal and Revision; Enforcement of foreign awards – New York and GenevaConvention Awards; Distinction between conciliation, negotiation, mediation and arbitration,confidentiality, resort to judicial proceedings, costs; Dispute Resolution Boards; LokAdalats.

UNIT 4 :*Engagement of Labour and Labour& other construction-related Laws:*Role ofLabour in Civil Engineering; Methods of engaging labour- on rolls, labour sub-contract, piece rate work; Industrial Disputes Act, 1947; Collective bargaining; Industrial Employment (Standing Orders) Act, 1946; Workmen's Compensation Act, 1923; Building & Other Construction Workers (regulation of employment and conditions of service) Act (1996) and Rules (1998); RERA Act 2017, NBC 2017

UNIT 5 : *Law relating to Intellectual property:*Introduction – meaning of intellectual property, main forms of IP, Copyright, Trademarks, Patents and Designs, Secrets; Law relating to Copyright in India including Historical evolution of Copy Rights Act, 1957, Meaning of copyright – computer programs, Ownership of copyrights and assignment, Criteria of infringement, Piracy in Internet – Remedies and procedures in India; Law relatingto Patents under Patents Act, 1970 including Concept and historical perspective of patentslaw in India, Patentable inventions with special reference to biotechnology products, Patent protection for computer programs, Process of obtaining patent – application, examination, opposition and sealing of patents, Patent cooperation treaty and grounds for opposition, Rights and obligations of patentee, Duration of patents – law and policy considerations, Infringement and related remedies;

Text/Reference Books:

1. B.S. Patil, Legal Aspects of Building and Engineering Contracts, 1974.
2. The National Building Code, BIS, 2017
3. RERA Act, 2017
4. MeenaRao (2006), Fundamental concepts in Law of Contract, 3rd Edn. Professional Offset
5. NeelimaChandiramani (2000), The Law of Contract: An Outline, 2nd Edn. AvinashPublications Mumbai
6. Avtarsingh (2002), Law of Contract, Eastern Book Co.
7. Dutt (1994), Indian Contract Act, Eastern Law House
8. Anson W.R. (1979), Law of Contract, Oxford University Press
9. Kwatra G.K. (2005), The Arbitration & Conciliation of Law in India with case law on UNCITRAL Model Law on Arbitration, Indian Council of Arbitration
10. Wadhera (2004), Intellectual Property Rights, Universal Law Publishing Co.
11. T. Ramappa (2010), Intellectual Property Rights Law in India, Asia Law House
12. Bare text (2005), Right to Information Act
13. O.P. Malhotra, Law of Industrial Disputes, N.M. Tripathi Publishers
14. K.M. Desai(1946), The Industrial Employment (Standing Orders) Act
15. Rustamji R.F., Introduction to the Law of Industrial Disputes, Asia Publishing House

Seventh/Eight Semester							
S. No.	Category	Code	Course Title	Hours per			Credits
				L	T	P	
7	Mandatory Course (non credit)	BTMC-701-18	**Management- I (Organizational Behavior**)	2	0	0	0

Course objectives: This course is based on three themes;

- Individuals – Behaviour in an individual context
- Groups/teams – Behavior in a n organizational context
- Organizations – How do these artificial persons behave?

Course context:
Unit 1 Organizational behavior: What managers do, Definition of OB, contributing disciplines to OB, challenges and opportunities for OB, Foundations of Individual Behavior, biographical characteristics, Learning, Attitudes, Personality: Determinants of personality, Perception: Meaning and attribution Theory.

Unit II Motivation: Definition and Process of motivation, Theories of motivation, Application of motivation. Job Satisfaction: Nature and significance of Job Satisfaction. Leadership: Meaning and theories of Leadership, Leadership in Indian culture, Nature and significance of Leadership. Transaction analysis, life position, Johari window, Emotional Intelligence and Intellectual Intelligence.

Unit III Foundation of group behavior: Nature and concept of group formation, stages of group formation, difference between group and team, Group Discussion Making: Meaning and nature: Decision making process; Conflict management: definition of conflict, Functional vs Dysfunctional conflict, conflict process; individual and group level conflict; organization level conflict; Negotiations: Meaning and definition; Negotiations process, issues in Negotiations.

Unit IV Stress Management: Meaning and concept of stress, Stress in organization, Management of stress,Power and Politics in Organization: Nature and concepts, Sources and types of power, techniques of politics, Organizational culture: Meaning and concept, cultural differences and business ethics.

Suggested Readings/Books:

1. Robbins, Organizational behavior, Pearson Education.
2. Luthans, Organizational behavior, Tata McGraw Hill
3. Parikh, Gupta, Organizational behavior, Tata McGraw Hill
4. Locum, Fundamental of Organizational behavior, Cengage Learning
5. Saiyadain, M S.: Organizational behavior, Tata McGraw Hill

WIDELY USED BOOKS FOR Organizational behavior

- I'm O.K You're O.K., Thomas Harris.
- Games people play, Eric Berne

Seventh/ Eighth Semester

S No	Category	Subject Code	Course Title	Evaluation Internal		External			Credits
				Institute	Industry		Ext	Total	
1	Training (one semester)	BTCE-801-18	Software Training And Project	100	50		100	250	16
			Industrial training and Project	100	50		100	250	
			Total	**200**	**100**		**200**	**500**	**16**

***List of Software for Training to be learnt during Training Period**
Any software that enhances professional capability in civil engineering practice a partial indicative list is mentioned below:

1. GT STRUDAL
2. PRIMA VERA
3. GEOTECH
4. ARCVIEW GIS
5. GEO 5
6. Ansys
7 AUTOCAD CIVIL 3D
8. MX ROAD
9. GEOMATIC
10. STAAD PRO
11. HDM-4
12. PLAXIS
13. Abacus
13. Any other relevant software

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours per week**			**Credits**
				L	**T**	**P**	
1	Professional Core courses	BTCE 802-18	**Smart Cities**	3	1	0	4

Course objectives

To obtain basic knowledge of smart cities
To learn how to analyze and compare existing smart community projects.

Unit-1:
Definition and concept ofsmart city, Difference between: Intelligent city, Digital city, and E-city,Objectives, principles, stages in to smart city planning, Smart city planning schemes.Complexities of Smart cities, Smart cities in India.

Unit-2:
Structure plan, detailed smart city planning scheme and action plan, Estimating future needs, planning standards for different land use allocation for commerce, industries, public amenities, open areas etc.,

Unit-3:
Smart infrastructure with adaptive capabilities; smartinfrastructures of energy, mobility, health and sustainabilityand their growing interdependencies.Cybersecurity, Safety, and Privacy.

Unit-4
ICT for smart City, Internet of Things, Blockchain, Artificial Intelligence, Alternate Reality, Virtual Reality, Future of Smart cities, Smart City Informatics

Reference Books:

1. Jo Beall (1997); “A city for all: valuing differences and working with diversity”; Zed books limited, London (ISBN: 1-85649-477-2)

2. UN-Habitat; “Inclusive and sustainable urban planning: a guide for municipalities”; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978-92-1-132024-4)

3. Arup Mitra; “Insights into inclusive growth, employment and wellbeing in India”; Springer (2013), New Delhi (ISBN: 978-81-322-0655-2)

4. William J. V. Neill (2004); “Urban Planning and cultural identity”; Routledge London (ISBN: 0-415-19747-3)

5. John S. Pipkin, Mark E. La Gory, Judith R. Balu (Editors); “Remaking the city: Social science perspective on urban design”; State University of New York Press, Albany (ISBN: 0-87395-678-8)

6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; NatašaPichler-Milanovic; Evert Meijers (2007). "Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science

Seventh/Eight Semester							
S. No.	**Category**	**Code**	**Course Title**	**Hours**			**Credits**
				L	**T**	**P**	
3	Professional core	BMPD-803-18	**Mentoring and professional development**	-	-	2	0

Guidelines regarding Mentoring and Professional Development
The objective of mentoring will be development of:

- Overall Personality
- Aptitude (Technical and General)
- General Awareness (Current Affairs and GK)
- Communication Skills
- Presentation Skills

The course shall be split in two sections i.e. outdoor activities and class activities. For achieving the above, suggestive list of activities to be conducted are:

Part – A (Class Activities)

1. Expert and video lectures
2. Aptitude Test
3. Group Discussion
4. Quiz (General/Technical)
5. Presentations by the students
6. Team building Exercises

Part – B (Outdoor Activities)

1. Sports/NSS/NCC
2. Society Activities of various students chapter i.e. ISTE, SCIE, SAE, CSI, Cultural Club, etc.

Evaluation shall be based on rubrics for Part – A & B.
Mentors/Faculty incharges shall maintain proper record student wise of each activity conducted and the same shall be submitted to the department.

End

Scheme & Syllabus of

Bachelor of Technology

Computer Science & Engineering

Batch 2018 onwards

(3rd -8th Semester)-

Affiliated colleges

By

Department of Academics

IK GujralPunjab Technical University

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Bachelor of Technology in Computer Science & Engineering

It is a Graduate (UG) Programme of 4 years duration (8 semesters)

Courses & Examination

Scheme: <u>Third Semester</u>

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTES 301-18	Engineering Science Course	Digital Electronics	3	0	0	40	60	100	3
BTCS 301-18	Professional Core Courses	Data structure & Algorithms	3	0	0	40	60	100	3
BTCS 302-18	Professional Core Courses	Object Oriented Programming	3	0	0	40	60	100	3
BTAM 304-18	Basic Science Course	Mathematics-III	3	0	0	40	60	100	3
HSMC 101/102-18	Humanities & Social Sciences Including Management \Courses	Foundation Course in Humanities (Development of Societies/Philosophy)	2	1	0	40	60	100	3
BTES 302-18	Engineering Science Course	Digital Electronics Lab	0	0	2	30	20	50	1
BTCS 303-18	Professional Core Courses	Data structure & Algorithms Lab	0	0	4	30	20	50	2
BTCS 304-18	Professional Core Courses	Object Oriented Programming lab.	0	0	4	30	20	50	2
BTCS 305-18	Professional Core Courses	IT Workshop*	0	0	2	30	20	50	1
		Summer Institutional Training	0	0	0	0	0	0	Satisfactory/Unsatisfactory
Total			**14**	**1**	**12**	**320**	**380**	**700**	**21**

*Syllabus to be decided by respective institute internally. It may include latest technologies.

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Fourth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS 401-18	Professional Core Courses	Discrete Mathematics	3	1	0	40	60	100	4
BTES 401-18	Engineering Science Course	Computer Organization & Architecture	3	0	0	40	60	100	3
BTCS 402-18	Professional Core Courses	Operating Systems	3	0	0	40	60	100	3
BTCS 403-18	Professional Core Courses	Design & Analysis of Algorithms	3	0	0	40	60	100	3
HSMC 122-18	Humanities & Social Sciences including Management Courses	Universal Human Values 2	2	1	0	40	60	100	3
EVS101-18	Mandatory Courses	Environmental Sciences	3	-	-	100	-	100	S/US
BTES 402-18	Engineering Science Course	Computer Organization & Architecture Lab	0	0	2	30	20	50	1
BTCS 404-18	Professional Core Courses	Operating Systems Lab	0	0	4	30	20	50	2
BTCS 405-18	Professional Core Courses	Design & Analysis of Algorithms Lab	0	0	4	30	20	50	2
Total			**15**	**2**	**10**	**390**	**360**	**750**	**24**

Students will take up summer internship of 4-6 weeks at industry or organizations of repute after 4^{th} sem, that will be accredited in 5^{th} semester.

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Fifth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTES 501-18	Engineering Science	Enterprise Resource Planning	3	0	0	40	60	100	3
BTCS 501-18	Professional Core Courses	Database Management Systems	3	0	0	40	60	100	3
BTCS 502-18	Professional Core Courses	Formal Language & Automata Theory	3	0	0	40	60	100	3
BTCS 503-18	Professional Core Courses	Software Engineering	3	0	0	40	60	100	3
BTCS 504-18	Professional Core Courses	Computer Networks	3	0	0	40	60	100	3
BTCS XXX-18	Professional Elective	Elective-I	3	0	0	40	60	100	3
MC	Mandatory Courses	Constitution of India/ Essence of Indian Traditional Knowledge	2	-	-	100	-	100	S/US
BTCS 505-18	Professional Core Courses	Database Management Systems Lab	0	0	4	30	20	50	2
BTCS 506-18	Professional Core Courses	Software Engineering Lab	0	0	2	30	20	50	1
BTCS 507-18	Professional Core Courses	Computer Networks Lab	0	0	2	30	20	50	1
BTCS XXX-18	Professional Elective	Elective-I Lab	0	0	2	30	20	50	1
	Professional Training	Industrial *Training	-	-	-	60	40	100	S/US
Total			**20**	**0**	**10**	**520**	**480**	**1000**	**23**

* 4-6 weeks industrial training undertaken after 4th semester in summer vacations.

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Sixth Semester

Course Code	Type of Course	Course Title	Hours per Week L	T	P	Marks Distribution Internal	External	Total Marks	Credits
BTCS 601-18	Professional Core Courses	Compiler Design	3	0	0	40	60	100	3
BTCS 602-18	Professional Core Courses	Artificial Intelligence	3	0	0	40	60	100	3
BTCS UUU-18	Professional Elective Courses	Elective-II	3	0	0	40	60	100	3
BTCS YYY-18	Professional Elective Courses	Elective-III	3	0	0	40	60	100	3
BTOE ***	Open Elective Courses	Open Elective-I	3	0	0	40	60	100	3
BTCS 603-18	Project	Project-1	0	0	6	60	40	100	3
BTCS 604-18	Professional Core Courses	Compiler Design Lab	0	0	2	30	20	50	1
BTCS 605-18	Professional Core Courses	Artificial Intelligence Lab	0	0	2	30	20	50	1
BTCS UUU-18	Professional Elective Courses	Elective-II lab	0	0	2	30	20	50	1
BTCS YYY-18	Professional Elective Courses	Elective-III lab	0	0	2	30	20	50	1
Total			**15**	**0**	**14**	**380**	**420**	**800**	**22**

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Seventh Semester / Eighth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS 701-18	Professional Core Courses	Network Security and Cryptography	3	0	0	40	60	100	3
BTCS 702-18	Professional Core Courses	Data Mining and Data Warehousing	3	0	0	40	60	100	3
BTOE ***	Open Elective Courses	Open Elective-II	3	0	0	40	60	100	3
BTCS ZZZ-18	Professional Elective	Elective- IV	3	0	0	40	60	100	3
BTCS TTT-18	Professional Elective Courses	Elective-V	3	0	0	40	60	100	3
BTCS 703-18	Project	Project-II	0	0	12	120	80	200	6
BTCS ZZZ-18	Professional Elective	Elective- IV lab	0	0	2	30	20	50	1
BTCS TTT-18	Professional Elective	Elective- V lab	0	0	2	30	20	50	1
Total			**15**	**0**	**14**	**380**	**420**	**800**	**23**

Seventh Semester / Eighth Semester

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
BTCS 801-18	Semester Training	300	200	500	16

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LIST OF ELECTIVES

BTCS XXX-18: Elective-I

BTCS 510-18	Programming in Python
BTCS 513-18	Programming in Python Lab
BTCS 515-18	Computer Graphics
BTCS 518-18	Computer Graphics lab
BTCS 520-18	Web Technologies
BTCS 522-18	Web Technologies lab
BTCS 521-18	Computational Biology
BTCS 523-18	Computational Biology lab

BTCS UUU-18: Elective-II

BTCS 606-18	Simulation and Modelling
BTCS 607-18	Simulation and Modelling Lab
BTCS 608-18	Internet of Things
BTCS 609-18	Internet of Things lab
BTCS 610-18	Digital Image processing
BTCS 611-18	Digital Image processing lab
BTCS 612-18	Cloud computing
BTCS 613-18	Cloud computing lab

BTCS YYY-18: Elective-III

BTCS 614-18	Software Project Management
BTCS 615-18	Software Project Management Lab
BTCS 616-18	Data Science
BTCS 617-18	Data Science lab
BTCS 618-18	Machine Learning
BTCS 619-18	Machine Learning lab
BTCS 620-18	Mobile Application Development
BTCS 621-18	Mobile Application Development lab

BTCS ZZZ-18: Elective-IV

BTCS 704-18	Deep Learning
BTCS 705-18	Deep Learning Lab
BTCS 706-18	Distributed databases
BTCS 707-18	Distributed databases lab
BTCS 708-18	Computer Vision
BTCS 709-18	Computer Vision lab
BTCS 710-18	Agile Software Development
BTCS 711-18	Agile Software Development lab

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<u>BTCS TTT-18: Elective-V</u>

BTCS 712-18	Blockchain Technologies
BTCS 713-18	Blockchain Technologies Lab
BTCS 714-18	Parallel Computing
BTCS 715-18	Parallel Computing lab
BTCS 716-18	Adhoc and Wireless sensor networks
BTCS 717-18	Adhoc and Wireless sensor networks lab
BTCS 718-18	Quantum Computing
BTCS 719-18	Quantum Computing lab

<u>Open electives offered by the department:</u>

BTCS301-18 Data Structures & Algorithms

BTCS302-18 Object Oritented Programming

BTES401-18 Computer organisation & Arcitecture

BTCS402-18 Operating system

BTCS501-18 Database Management System

BTCS504-18 Computer Networks

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MINOR DEGREE IN COMPUTER SCIENCE ENGG.(Credits required 20 from Core+Electives/MOOCS*)

List of Core Courses:Minimum of 2 courses must be opted, other than studied in regular course

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS301-18& BTCS303-18	PCC	Data structure Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
BTCS302-18 & BTCS304-18	PCC	Object Oriented Programming Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
BTCS504-18 & BTCS507-18	PCC	Computer networks Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
BTCS402-18 & BTCS404-18	PCC	Operating system Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
BTES401-18 & BTCS402-18	ESC	Computer Organisation and architecture Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
BTCS501-18 & BTCS504-18	PCC	Database Management system Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5

*List of Courses through MOOCS will be provided every six months through BOS/ MOOCS Coordinator; each course must be of minimum 12 weeks and of 4 credits after submission of successful exam in that course.

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List of Electives: 3 courses can be opted, other than studied in regular course

Course Code**	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
	ELECTIVE	Web Technologies Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Machine Learning Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Cloud computing Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Adhoc and Sensor network Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Data Science Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Computer Graphics Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Mobile Application Development Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Data Mining &Warehousing Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Information Theory & Coding Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
	ELECTIVE	Soft Computing Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4

** Refer to the scheme above for the course codes of respective courses.

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Third Semester

Course Code: BTCS301-18	**Course Title:** Data Structure & Algorithms	**3L:0T:P**	**3Credits**

Detailed Contents:

Module 1: Introduction

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off.

Searching: Linear Search and Binary Search Techniques and their complexity analysis.

[6 hrs] (CO1)

Module 2: Stacks and Queues

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each types of Queues: Algorithms and their analysis.

[10 hrs] (CO2, CO4, CO5)

Module 3: Linked Lists

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, Doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: All operations their algorithms and the complexity analysis.

Trees: Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees. B Tree, B+ Tree: definitions, algorithms and analysis.

[10 hrs] (CO2, CO4, CO5)

Module 4: Sorting and Hashing

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

[10 hrs] (CO3)

Module 4: Graph

Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

[6 hrs] (CO2, CO4)

Course Outcomes:

The student will be able to:

1. For a given algorithm student will able to analyze the algorithms to determine the time and computation complexity and justify the correctness;
2. Student will be able to handle operation like searching, insertion, deletion, traversing on various Data Structures and determine time and computational complexity;
3. Student will able to write an algorithm Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort and compare their performance in term of Space and Time complexity;
4. Students will be able to choose appropriate Data Structure as applied to specific problem definition; &

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5. Demonstrate the reusability of Data Structures for implementing complex iterative problems.

Suggested Books:

1. "Classic Data Structures", Samanta and Debasis, 2nd edition, PHI publishers.
2. "Fundamentals of Data Structures", Illustrated Edition by Ellis Horowitz, SartajSahni, Computer Science Press.
3. "Data Structures with C (Schaum's Outline Series)", Seymour Lipschutz, 1st edition,McGraw Hill Education.

Reference Books:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company.
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.

Course Code: BTCS302-18	**Course Title:** Object Oriented Programming	**3L:0T:0P**	**3Credits**

Pre-requisites: Programming in C

Detailed Contents:

Module 1: Introduction

Overview of C++, Sample C++ program, Different data types, operators, expressions, and statements, arrays and strings, pointers & function components, recursive functions, user - defined types, function overloading, inline functions, Classes & Objects – I: classes, Scope resolution operator, passing objects as arguments, returning objects, and object assignment.

[8 hrs] (CO1)

Module 2: Classes & Objects –II

Constructors, Destructors, friend functions, Parameterized constructors, Static data members, Functions, Arrays of objects, Pointers to objects, this pointer, and reference parameter, Dynamic allocation of objects, Copyconstructors, Operator overloading using friend functions, overloading.

[8 hrs] (CO1, CO2)

Module 3: Inheritance

Base Class, Inheritance and protected members, Protected base class inheritance, Inheriting multiple base classes, Constructors, Destructors and Inheritance, Passing parameters to base class constructors, Granting access, Virtual base classes.

[8 hrs] (CO3, CO4)

Module 4: Virtual functions, Polymorphism

Virtual function, calling a Virtual function through a base class reference, Virtual attribute is inherited, Virtual functions are hierarchical, pure virtual functions, Abstract classes, Using virtual functions, Early and late binding.

[8 hrs] (CO3, CO4)

Module 5: Exception Handling

Basics of exception handling, exception handling mechanism, throwing mechanism, catching mechanism, I/O System Basics, File I/0: Exception handling fundamentals, Exception handling options. C++ stream classes, Formatted I/O, fstream and the File classes, Opening and closing a file, Reading and writing text files.

[10 hrs] (CO5)

Course Outcomes:

The student will be able to:

1. Identify classes, objects, members of a class and the relationships among them needed to solve a specific problem;
2. Demonstrate the concept of constructors and destructors. And create new definitions for some of the operators;
3. Create function templates, overload function templates;
4. Understand and demonstrate the concept of data encapsulation, inheritance, polymorphism with virtual functions; &
5. Demonstrate the concept of file operations, streams in C++ and various I/O manipulators.

Suggested Books:

1. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill.

Reference Books:

1. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.
2. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2011.

Course Code: BTCS303-18	**Course Title:** Data Structure & AlgorithmsLab	**0L:0T:4P**	**2Credits**

List of Experiment:

Task 1: Write a program to insert a new element at end as well as at a given position in an array.

Task 2: Write a program to delete an element from a given whose value is given or whose position is given.

Task 3: Write a program to find the location of a given element using Linear Search.

Task 4: Write a program to find the location of a given element using Binary Search.

Task 5: Write a program to implement push and pop operations on a stack using linear array.

Task 6: Write a program to convert an infix expression to a postfix expression using stacks.

Task 7: Write a program to evaluate a postfix expression using stacks.

Task 8: Write a recursive function for Tower of Hanoi problem.

Task 9: Write a program to implement insertion and deletion operations in a queue using linear array.

Task 10: Write a menu driven program to perform following insertion operations in a single linked list:

i. Insertion at beginning
ii. Insertion at end
iii. Insertion after a given node
iv. Traversing a linked list

Task 11: Write a menu driven program to perform following deletion operations in a single linked list:

i. Deletion at beginning
ii. Deletion at end
iii. Deletion after a given node

Task 12: Write a program to implement push and pop operations on a stack using linked list.

Task 13: Write a program to implement push and pop operations on a queue using linked list.

Task 14: Program to sort an array of integers in ascending order using bubble sort.

Task 15: Program to sort an array of integers in ascending order using selection sort.

Task 16: Program to sort an array of integers in ascending order using insertion sort.

Task 17: Program to sort an array of integers in ascending order using quick sort.

Task 18: Program to traverse a Binary search tree in Pre-order, In-order and Post-order.

Task 19: Program to traverse graphs using BFS.

Task 20: Program to traverse graphs using DFS.

Lab Outcomes:

The student will be able to:

1. Improve practical skills in designing and implementing basic linear data structure algorithms;
2. Improve practical skills in designing and implementing Non-linear data structure algorithms;
3. Use Linear and Non-Linear data structures to solve relevant problems;
4. Choose appropriate Data Structure as applied to specific problem definition; &
5. Implement Various searching algorithms and become familiar with their design methods.

Reference Books:

1. “Data Structures with C (Schaum's Outline Series)”, Seymour Lipschutz, 1st edition,McGraw Hill Education.

Course Code: BTCS304-18	**Course Title:** Object Oriented Programming Lab	**0L:0T:4P**	**2Credits**

<u>List of Experiment:</u>

Task 1: Write a program that uses a class where the member functions are defined inside a class.

Task 2: Write a program that uses a class where the member functions are defined outside a class.

Task 3: Write a program to demonstrate the use of static data members.

Task 4: Write a program to demonstrate the use of const data members.

Task 5: Write a program to demonstrate the use of zero argument and parameterized constructors.

Task 6: Write a program to demonstrate the use of dynamic constructor.

Task 7: Write a program to demonstrate the use of explicit constructor.

Task 8: Write a program to demonstrate the use of initializer list.

Task 9: Write a program to demonstrate the overloading of increment and decrement operators.

Task 10: Write a program to demonstrate the overloading of memory management operators.

Task 11: Write a program to demonstrate the typecasting of basic type to class type.

Task 12: Write a program to demonstrate the typecasting of class type to basic type.

Task 13: Write a program to demonstrate the typecasting of class type to class type.

Task 14: Write a program to demonstrate the multiple inheritances.

Task 15: Write a program to demonstrate the runtime polymorphism.

Task 16: Write a program to demonstrate the exception handling.

Task 17: Write a program to demonstrate the use of class template.

Task 18: Write a program to demonstrate the reading and writing of mixed type of data.

Lab Outcomes:

The student will be able to:

1. Develop classes incorporating object-oriented techniques;
2. Design and implement object-oriented concepts of inheritance and polymorphism;
3. Illustrate and implement STL class of containers and need for exceptions to handle errors for object oriented programs; &
4. Design and implement any real world based problem involving GUI interface using object-oriented concepts.

Reference Books:

1. Stanley B.Lippmann, JoseeLajoie: C++ Primer, 4th Edition, Addison Wesley, 2012.
2. E. Balagurusamy, Object Oriented Programming with C++, Tata McGraw Hill.

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BTAM304-18	Mathematics Paper-III (Calculus and Ordinary Differential Equations)	4L:1T:0P	4 credits

Detailed Contents:

Module 1:

Limit, continuity for functions with severable variables, partial derivatives, total derivative, Maxima, minima and saddle points; Method of Lagrange multipliers, Multiple Integration: double and triple integrals (Cartesian and polar), Change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications of double and triple integrals to find surface area and volumes.
[CO1, CO2] **(12Hrs)**

Module 2:

Sequence and series, Bolzano Weirstrass Theorem, Cauchy convergence criterion for sequence, uniform convergence, convergence of positive term series: comparison test, limit comparison test, D'Alembert's ratio test, Raabe's test, Cauchy root test, p-test, Cauchy integral test, logarithmic test, Alternating series, Leibnitz test, Power series, Taylor's series, Series for exponential, trigonometric and logarithmic functions. [CO3] **(13Hrs.)**

Module 3:

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.
[CO4**] (12 hrs.)**

Module 4:

Second and higher order linear differential equations with constant coefficients, method of variation of parameters, Equations reducible to linear equations with constant coefficients: Cauchy and Legendre's equations. [CO5] **(12 hrs.)**

Course Outcomes: At the end of the course, the student will be able to:

1. Understand the functions of several variables that are essential in mostbranches of engineering;
2. Apply multiple integrals to deal with areas and volumes of various structures which are quite significant in real world;
3. Formulate and solveengineering problems related to convergence, infinite series, power series and Taylor series;
4. Create, select and utilize the learnt techniques of first degree ordinary differential equationsto model real world problems &;
5. Be acquainted with the knowledge required to solve higher order ordinary differential equations.

Textbooks/References:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9^{th} Edition, Pearson, Reprint, 2002.
2. T. Veerarajan, Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9^{th} Edition, John Wiley & Sons, 2006.
5. W.E. Boyce and R.C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
6. E.A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India,

1995.

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Development of Societies
Course code: HSMC101-18

Credits: 3

COURSE TOPICS:

2.1 Unit I: Social Development (5 hours)

1. Concepts behind the origin of Family, Clan and Society
2. Different Social Systems
3. Relation between Human being and Society
4. Comparative studies on different models of Social Structures and their evolution

2.2 Unit II: Political Development (3 hours)

1. Ideas of Political Systems as learnt from History
2. Different models of Governing system and their comparative study

2.3 Unit III: Economic Development (18 hours)

1. Birth of Capitalism, Socialism, Marxism
2. Concept of development in pre-British, British and post British period- Barter, Jajmani
3. Idea of development in current context.
4. E. F. Schumacher's idea of development, Buddhist economics.

Gandhian idea of development. Swaraj and Decentralization.

3. READINGS

3.1 TEXTBOOK:

3.2 *REFERENCE BOOKS:

4. OTHER SESSIONS

4.1 *TUTORIALS:

4.2 *LABORATORY:

4.3 *PROJECT: Possible projects in this course could be

a) Interact with local communities and understand their issues.

b) Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.

c) Evaluation of technology in the context of its application. Social impact of technology. Environmental impact of technology. Evaluation from a holistic perspective.

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PHILOSOPHY Course
code: HSMC102-18

Credits: 3

COURSE TOPICS:

2.1 Unit 1:
The difference between knowledge (Vidya) and Ignorance (Avidya):
a. Upanishads;
b. Six systems orthodox and Heterodox Schools of Indian Philosophy.
c. Greek Philosophy:

2.2 Unit 2:
Origin of the Universe:

- NasidiyaSukta: "Who really knows?"
- Brhadaranyaka Upanishad; Chandogya Upanishad: Non-self, Self, real and unreal.
- Taittiriya Upanishad: SikshaValli.
- Plato's Symposium: Lack as the source of desire and knowledge.
- Socratic's method of knowledge as discovery.
- Language: Word as root of knowledge (Bhartrahari'sVakyapadiyam)
- Fourteen Knowledge basis as a sources of Vidya: Four Vedas; Six auxiliary sciences (Vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.

2.3 Unit 3:
Knowledge as Power: Francis Bacon. Knowledge as both power and self-realization in Bagavad Gita.

2.4 Unit 4:
Knowledge as oppression: M. Foucault. Discrimination between Rtam and Satyam in Indian Philosophy.

2.5 Unit 5:
Knowledge as invention: Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.

2.6 Unit 6:
Knowledge about the self, transcendental self; knowledge about society, polity and nature.

2.7 Unit 7:
Knowledge about moral and ethics codes.

2.8 Unit 8:
Tools of acquiring knowledge: Tantrayuktis, a system of inquiry (Caraka, Sushruta, Kautilya, Vyasa)

3. READINGS

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1. Copleston, Frederick, History of Philosophy, Vol. 1.Great Britain: Continuum.
2 Hiriyanna, M. Outlines of Indian Philosophy, MotilalBanarsidass Publishers; Fifth Reprint edition (2009)
3 Sathaye, Avinash, Translation of NasadiyaSukta
4. Ralph T. H. Griffith. The Hymns of the Ṛgveda. MotilalBanarsidass: Delhi: 1973.
5. Raju, P. T. Structural Depths of Indian Thought, Albany: State University of New York Press.
6. Plato, Symposium, Hamilton Press.
7. KautilyaArtha Sastra. Penguin Books, New Delhi.
8. Bacon, Nova Orgum
9. Arnold, Edwin. The Song Celestial.
10. Foucault, Knowledge/Power.
11. Wildon, Anthony, System of Structure.
12. Lele, W.K. The Doctrine of Tantrayukti. Varanasi: Chowkamba Series.
13. Dasgupta, S. N. History of Indian Philosophy, MotilalBanasidas, Delhi.
14. Passmore, John, Hundred Years of Philosophy, Penguin.

4. OTHER SESSIONS:

4.1 Mode of Conduct

5. ASSESSMENT (indicative only):

Ask students to do term papers, for example, writing biographical details of founders, sustainers, transmitters, modifiers, rewriters; translating monographs of less known philosophers such as K. C. Bhattacharys, Daya Krishna, Gopinath Bhattacharya; comparative study of philosophical system such as MadhyasthaDarshan.

6. OUTCOME OF THE COURSE:

Students will develop strong natural familiarity with humanities along with right understanding enabling them to eliminate conflict and strife in the individual and society. Students shall be able to relate philosophy to literature, culture, society and lived experience can be considered.

Course Code:BTES301-18	Course Title: Digital Electronics	3L:0T:0P	3Credits

Detailed Contents:

Module 1:

NUMBER SYSTEMS: Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2's complements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Gray code, Excess 3 code, ASCII.
LOGIC GATES: AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR. Implementations of Logic Functions using gates, NAND-NOR implementations.

Module 2 :
BOOLEAN ALGEBRA: Boolean postulates and laws – De-Morgan's Theorem, Principle of Duality, Boolean expression – Boolean function, Minimization of Boolean expressions – Sum of Products (SOP), Product of Sums (POS), Minterm, Maxterm, Canonical forms, Conversion between canonical forms, Karnaugh map Minimization, Don't care conditions, Quine-McCluskey method.

Module 3:
COMBINATIONAL CIRCUITS: Design procedure – Adders, Subtractors, BCD adder, Magnitude Comparator, Multiplexer/Demultiplexer, encoder/decoder, parity checker, code converters. Implementation of combinational logic using MUX, BCD to 7 segment decoder.

SEQUENTIAL CIRCUITS: Flip flops SR, JK, T, D and Master slave, Excitation table, Edge triggering, Level Triggering, Realization of one flip flop using other flip flops. Asynchronous/Ripple counters, Synchronous counters, Modulo-n counter, Ring Counters. Design of Synchronous counters: state diagram, Circuit implementation. Shift registers.

Module 4:
MEMORY DEVICES: Classification of memories, RAM organization, Write operation, Read operation, Memory cycle. ROM organization, PROM, EPROM, EEPROM, Programmable logic array, Programmable array logic, complex Programmable logic devices (CPLDS), Field Programmable Gate Array (FPGA).

A/D & D/A CONVERTORS : Analog & Digital signals. sample and hold circuit, A/D and D/A conversion techniques (Weighted type, R-2R Ladder type, Counter Type, Dual Slope type, Successive Approximation type).

COURSE OUTCOME:At the end of course the student will be able to:
1. Demonstrate the operation of simple digital gates, identify the symbols, develop the truth table for those gates; combine simple gates into more complex circuits; change binary, hexadecimal, octal numbers to their decimal equivalent an vice versa.
2. Demonstrate the operation of a flip-flop. Design counters and clear the concept of shift registers.
3. Study different types of memories and their applications.Convert digital signal into analog and vice versa.

Suggested Readings/ Books:

- Morris Mano, **Digital Design**, Prentice Hall of India Pvt. Ltd
- Donald P.Leach and Albert Paul Malvino, **Digital Principles and Applications**, 5 ed., Tata McGraw HillPublishing CompanyLimited, New Delhi, 2003.
- R.P.Jain, **Modern Digital Electronics**, 3 ed., Tata McGraw–Hill publishing company limited, New Delhi, 2003.
- Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, Inc, New Delhi, 2003
- Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System - Principles and Applications**, PearsonEducation.
- Ghosal ,**Digital Electronics**, Cengage Learning.

Course Code:BTES302-18	**Course Title: Digital Electronics Lab**	**0L:0T:2P**	**1Credits**

List of Experiments:

1. To verify the Truth-tables of all logic gates.
2. To realize and verify the Half & full adder circuits using logic gates.
3. To realize Half & full subtractor circuits using logic gates.
4. To realize Encoder and Decoder circuits
5. To realize Multiplexer circuits
6. To realize 4-bit binary-gray & gray-binary converters.
7. To realize comparator circuit for two binary numbers of 2-bit each.
8. To realize Full adder & full subtractor circuits using encoder.
9. To design Full adder & full subtractor circuits using multiplexer.
10. To design and verify the Truth tables of all flip-flops.
11. To design Mod-6/Mod-9 synchronous up-down counter.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Realize combinational circuits using logic gates.
2. Realize sequential circuits using logic gates.
3. Realize various types of Flip-flops and counters

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Fourth Semester

Course Code: BTES401-18	Course Title: Computer Organization & Architecture	3L:0T:0P	3Credits

Pre-requisites: Digital Electronics

Detailed Contents:

Module 1: Functional blocks of a computer

CPU, memory, input-output subsystems, control unit. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction set of 8085 processor.

Data representation: signed number representation, fixed and floating point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-andadd, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

[10 hrs] (CO1, CO2)

Module 2: Introduction to x86 architecture.

CPU control unit design: Hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU.

Memory system design: semiconductor memory technologies, memory organization.

Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers – program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions. Programs and processes –role of interrupts in process state transitions, I/O device interfaces – SCII, USB.

[12 hrs] (CO2, CO4)

Module 3: Pipelining

Basic concepts of pipelining, throughput and speedup, pipeline hazards.

Parallel Processors: Introduction to parallelprocessors, Concurrent access to memory and cache coherency.

[10 hrs] (CO5)

Module 4: Memory Organization

Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.

[10 hrs] (CO3)

Course Outcomes:

The student will be able to:

1. Understand functional block diagram of microprocessor;
2. Apply instruction set for Writingassembly language programs;
3. Design a memory module and analyze its operation by interfacing with the CPU;
4. Classify hardwired and microprogrammed control units; &
5. Understand the concept of pipelining and its performance metrics.

Suggested Books:

1. "ComputerOrganization and Architecture", Moris Mano,
2. "ComputerOrganization and Design: The Hardware/Software Interface", 5th Edition by David A. Patterson and John L. Hennessy, Elsevier.
3. "Computer Organization and Embedded Systems", 6th Edition by CarlHamacher, McGraw Hill Higher Education.

Reference Books:

1. "Computer Architecture and Organization", 3rd Edition by John P. Hayes, WCB/McGraw-Hill
2. "Computer Organization and Architecture: Designing for Performance", 10th Edition by William Stallings, Pearson Education.
3. "Computer System Design and Architecture", 2nd Edition by Vincent P. Heuring and Harry F. Jordan, Pearson Education.

Course Code: BTCS402-18	**Course Title:** Operating Systems	**3L:0T:0P**	**3Credits**

Detailed Contents:

Module 1: Introduction

Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS Operating System.

[6 hrs] (CO1)

Module 2: Processes

Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread: Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads,

Process Scheduling: Foundation and Scheduling objectives, Types of Schedulers, Scheduling criteria: CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non-pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

[10 hrs] (CO2, CO3)

Module 3: Inter-process Communication

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, StrictAlternation, Peterson's Solution, TheProducer\ConsumerProblem, Semaphores,EventCounters,Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

[8 hrs] (CO2)

Module 4: Deadlocks

Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

[8 hrs] (CO3)

Module 5: MemoryManagement

Basicconcept,LogicalandPhysical address map, Memory allocation: Contiguous Memory allocation –Fixedandvariable partition–Internaland External fragmentation and Compaction; Paging: Principle of operation – Page allocation–Hardware support for paging, Protection and sharing, Disadvantages of paging.

Virtual Memory: Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

[10 hrs] (CO4)

Module 6: I/O Hardware

I/O devices, Device controllers, Direct memory access Principles of I/O Software: Goals of Interrupt handlers, Device drivers, Device independent I/O software, Secondary-Storage Structure: Disk structure, Disk scheduling algorithms

File Management: Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocationmethods (contiguous, linked, indexed), Free Space Management (bit vector, linked list, grouping), directory implementation (linear list, hash table), efficiency and performance.

Disk Management: Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, Disk reliability, Disk formatting, Boot-block, Bad blocks.

[8 hrs] (CO5, CO6)

Course Outcomes:

The student will be able to:

1. Explain basic operating system concepts such as overall architecture, system calls, user mode and kernel mode;
2. Distinguish concepts related to processes, threads, process scheduling, race conditions and critical sections;
3. Analyze and apply CPU scheduling algorithms, deadlock detection and prevention algorithms;
4. Examine and categorize various memory management techniques like caching, paging, segmentation, virtual memory, and thrashing;
5. Design and implement file management system; &
6. Appraise high-level operating systems concepts such as file systems, disk-scheduling algorithms and various file systems.

Suggested Books:

1. Operating System Concepts Essentials, 9th Edition by AviSilberschatz, Peter Galvin, Greg Gagne, Wiley Asia Student Edition.
2. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.

Reference Books:

1. Operating System: A Design-oriented Approach, 1st Edition by Charles Crowley, Irwin Publishing
2. Operating Systems: A Modern Perspective, 2nd Edition by Gary J. Nutt, Addison-Wesley
3. Design of the Unix Operating Systems, 8th Edition by Maurice Bach, Prentice-Hall of India
4. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly and Associates

Course Code: BTCS403-18	**Course Title:** Design and Analysis of Algorithms	**3L:0T:0P**	**3Credits**

Pre-requisites: Data Structures

Detailed Contents:

Module 1: Introduction

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds – best, average and worst-case behavior; Performance measurements of Algorithm, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

[8 hrs] (CO1)

Module 2: Fundamental Algorithmic Strategies

Brute-Force, Greedy,Dynamic Programming, Branch- and-Bound and Backtracking methodologies for the design of algorithms; Illustrations of these techniques for Problem-Solving: Bin Packing, Knap Sack, TSP.

[10 hrs] (CO1, CO2)

Module 3: Graph and Tree Algorithms

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Shortest path algorithms, Transitive closure, Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

[10 hrs] (CO3)

Module 4: Tractable and Intractable Problems

Computability of Algorithms, Computability classes – P, NP, NP-complete and NP-hard. Cook's theorem, Standard NP-complete problems and Reduction techniques.

[8 hrs] (CO5)

Module 5: Advanced Topics

Approximation algorithms, Randomized algorithms, Heuristics and their characteristics.

[6 hrs] (CO1, CO4, CO5)

Course Outcomes:

The student will be able to:

1. For a given algorithms analyze worst-case running times of algorithms based on asymptotic analysis and justify the correctness of algorithms;
2. Explain when an algorithmic design situation calls for which design paradigm (greedy/ divide and conquer/backtrack etc.);
3. Explain model for a given engineering problem, using tree or graph, and writethe corresponding algorithm to solve the problems;
4. Demonstrate the ways to analyze approximation/randomized algorithms (expected running time, probability of error); &
5. Examine the necessity for NP class based problems and explain the use of heuristic techniques.

Suggested Books:

1. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles E Lieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.

2. Data Structures and Algorithms in C++, Weiss, 4th edition, Pearson.
3. Fundamentals of Computer Algorithms – E. Horowitz, Sartaj Saini, Galgota Publications.

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Reference Books
1. Algorithm Design, 1st Edition, Jon Kleinberg and ÉvaTardos, Pearson.
2. Algorithm Design: Foundations, Analysis, and Internet Examples, Second Edition, Michael T Goodrich and Roberto Tamassia, Wiley.
3. Algorithms -- A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

Course Code: BTES402-18	**Course Title:** Computer Organization & ArchitectureLab	**0L:0T:2P**	**1Credits**

List of Experiment:

Task 1: Computer Anatomy- Memory, Ports, Motherboard and add-on cards.
Task 2: Dismantling and assembling PC.
Task 3: Introduction to 8085 kit.
Task 4: 2. Addition of two 8 bit numbers, sum 8 bit.
Task 5: Subtraction of two 8 bit numbers.
Task 6: Find 1's complement of 8-bit number.
Task 7: Find 2's complement of 8-bit number.
Task 8: Shift an 8-bit no. by one bit.
Task 9: Find Largest of two 8 bit numbers.
Task 10: Find Largest among an array of ten numbers (8 bit).
Task 11: Sum of series of 8 bit numbers.
Task 12: Introduction to 8086 kit.
Task 13: Addition and subtraction of two 16 bit numbers, sum 16 bit.
Task 14: Implement of Booth's algorithm for arithmetic operations.
Task 15: Find 1's and 2's complement of 16-bit number.
Task 16: Implement simple programs using I/O based interface.

Lab Outcomes:

The student will be able to:
1. Assemble personal computer;
2. Implement the various assembly language programs for basic arithmetic and logical operations; &
3. Demonstrate the functioning of microprocessor/microcontroller based systems with I/O interface.

Reference Books:
1. Fundamentals of Microprocessors and Microcontrollersby B. Ram, Dhanpat Rai Publications.

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Course Code: BTCS404-18	**Course Title:** Operating Systems Lab	**0L:0T:4P**	**2Credits**

List of Experiment:

Task 1: Installation Process of various operating systems.

Task 2: Implementation of CPU scheduling algorithms to find turnaround time and waiting time. a) FCFS b) SJF c) Round Robin (pre-emptive) d) Priority.

Task 3: Virtualization, Installation of Virtual Machine Software and installation of Operating System on Virtual Machine.

Task 4: Commands for files & directories: cd, ls, cp, md, rm, mkdir, rmdir. Creating and viewing files using cat. File comparisons. Disk related commands: checking disk free spaces. Processes in linux, connecting processes with pipes, background processing, managing multiple processes. Background process: changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep. Printing commands, grep, fgrep, find, sort, cal, banner, touch, file. File related commands ws, sat, cut, grep.

Task 5: Shell Programming: Basic of shell programming, various types of shell, Shell Programming in bash, conditional & looping statement, case statements, parameter passing and arguments, shell variables, shell keywords, creating shell programs for automate system tasks, report printing.

Task 6: Implementation of Bankers algorithm for the purpose of deadlock avoidance.

Lab Outcomes:

The student will be able to:

1. Understand and implement basic services and functionalities of the operating system;
2. Analyze and simulate CPU Scheduling Algorithms like FCFS, Round Robin, SJF, and Priority;
3. Implement commands for files and directories;
4. Understand and implement the concepts of shell programming;
5. Simulate file allocation and organization techniques; &
6. Understand the concepts of deadlock in operating systems and implement them in multiprogramming system.

Reference Books:

1. Operating Systems: Design and Implementation, Albert S. Woodhull and Andrew S. Tanenbaum, Pearson Education.

Course Code: BTCS405-18	**Course Title:** Design and Analysis of Algorithms Lab	**0L:0T:4P**	**2Credit**

List of Experiment:

Task 1: Code and analyze solutions to following problem with given strategies:
- i. Knap Sack using greedy approach
- ii. Knap Sack using dynamic approach

Task 2: Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.

Task 3: Code and analyze to find an optimal solution to TSP using dynamic programming.

Task 4: Implementing an application of DFS such as:
- i. to find the topological sort of a directed acyclic graph
- ii. to find a path from source to goal in a maze.

Task 5: Implement an application of BFS such as:
- i. to find connected components of an undirected graph
- ii. to check whether a given graph is bipartite.

Task 6: Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra's algorithm.

Task 7: Code and analyze to find shortest paths in a graph with arbitrary edge weights using Bellman-Ford algorithm.

Task 8: Code and analyze to find shortest paths in a graph with arbitrary edge weights using Flyods' algorithm.

Task 9: Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Prims' algorithm

Task 10: Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Kruskals' algorithm.

Task 11: Coding any real world problem or TSP algorithm using any heuristic technique.

Lab Outcomes:

The student will be able to:
1. Improve practical skills in designing and implementing complex problems with different techniques;
2. Understand comparative performance of strategies and hence choose appropriate, to apply to specific problem definition;
3. Implement Various tree and graph based algorithms and become familiar with their design methods; &
4. Design and Implement heuristics for real world problems.

Reference Books

1. Data Structures and Algorithms in C++, Weiss, 4th edition, Pearson
2. Data Structures and Algorithms using Python and C++, David M. Reed and John Zelle, 2009 edition (available as e book), Franklin Beedle& Associates.

UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Course code: HSMC122-18

Credits: 3

COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration–what is it? - Its content and process; ‘Natural Acceptance’ and ExperientialValidation- as the process for self-exploration.
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

Module 2: Understanding Harmony in the Human Being - Harmony in Myself!

7. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’
8. Understanding the needs of Self (‘I’) and ‘Body’ - happiness and physical facility
9. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)
10. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’
11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
12. Programs to ensureSanyam and Health.

Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one’s own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship.
14. Understanding the meaning of Trust; Difference between intention and competence
15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.

17. Visualizing a universal harmonious order in society- Undivided Society,

Universal Order- from family to world family.
Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

Module 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

Module 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendly and eco -friendly production systems, c. Ability to identify and develop appropriatetechnologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems.
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations.
28. Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. to discuss the conduct as an engineer or scientist etc.

3. READINGS:

3.1 Text Book

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010.

3.2 Reference Books

1. Jeevan Vidya: EkParichaya, A. Nagaraj, Jeevan VidyaPrakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5. Small is Beautiful - E. F Schumacher.

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6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J CKumarappa
8. Bharat Mein Angreji Raj -PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

OUTCOME OF THE COURSE:

By the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature); they would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind. They would have better critical ability. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society). It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

This is only an introductory foundational input. It would be desirable to follow it up by

a) Faculty -student or mentor-mentee programs throughout their time with the institution.

b) Higher level courses on human values in every aspect of living. E.g. as a professional.

Course Code: EVS101-18	**Course Title: Environmental Studies-**	**L:2; T:0; P:0**	**0Credits**

.Detailed Contents

Module 1 : Natural Resources :Renewable and non-renewable resources

Natural resources and associated problems.

a) Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources : Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resoureces for sustainable lifestyles.
-

Module 2 : Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem.

Food chains, food webs and ecological pyramids. Introduction, types, characteristic features,

structure and function of following ecosystems:
a. Forest ecosystem
b. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Module 3 : Biodiversity and its conservation
- Introduction – Definition : genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- Inida as a mega-diversity nation
- Hot-sports of biodiversity.
- Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
- Endangered and endemic species of India
-

Module 4 : Social Issues and the Environment
- From Unsustainable to Sustainable development
- Resettlement and rahabilitation of people; its problems and concerns.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies.
- Public awareness.

***ACTIVITIES**
Nature club (bird watching, recognizing plants at institute/at home, recognizing local animals, appreciating biodiversity
Impart knowledge and inculcate the habit of taking interest and understanding biodiversity in and around the college campus. The students should be encouraged to take interest in bird watching, recognizing local plants, herbs and local animals. The students should be encouraged to appreciate the difference in the local biodiversity in their hometown, in the place of their study and other places they visit for vacation/breaks etc.
Following activities must be included.
Identify a tree fruit flower peculiar to a place or having origin from the place.
Making high resolution big photographs of small creatures (bees, spiders, ants. mosquitos etc.) especially part of body so that people can recognize (games on recognizing animals/plants).
Videography/ photography/ information collections on specialties/unique features of different types of common creatures.
Search and explore patents and rights related to animals, trees etc. Studying miracles of mechanisms of different body systems.
1*(A) Awareness Activities:*
a) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste
b) Slogan making event
c) Poster making event
d) Cycle rally
e) Lectures from experts
f) Plantation
g) Gifting a tree to see its full growth
h) Cleanliness drive
i) Drive for segregation of waste
i) To live with some eminent environmentalist for a week or so to understand his work vi) To work in kitchen garden for mess
j) To know about the different varieties of plants
k) Shutting down the fans and ACs of the campus for an hour or so
l) Visit to a local area to document environmental assets

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river/forest/grassland/hill/mountain/lake/Estuary/Wetlands

m) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural
n) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

Suggested Readings

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad – 380 013, India, Email:mapin@icenet.net (R)
3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p
4. Clark R.S., Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Publ. House, Mumabai, 1196p
6. Hawkins R.E., Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R)
7. Heywood, V.H &Waston, R.T. 1995. Global Biodiversity Assessment. Cambridge Univ. Press 1140p.
8. Mhaskar A.K., Matter Hazardous, Techno-Science Publication (TB)
9. Miller T.G. Jr. Environmental Science, Wadsworth Publishing Co. (TB)
10. Odum, E.P. 1971. Fundamentals of Ecology. W.B. Saunders Co. USA, 574p
11. Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (TB)
12. Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Stadards, Vol I and II, Enviro Media (R)
13. Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (TB)
14. Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p

Course Code: HSMC101-18	Course Title: Development of Societies	3L:0T:0P	3Credits

Detailed Contents:

Unit I: Social Development (5 hours)

1. Concepts behind the origin of Family, Clan and Society
2. Different Social Systems
3. Relation between Human being and Society
4. Comparative studies on different models of Social Structures and their evolution

Unit II: Political Development (3 hours)

1. Ideas of Political Systems as learnt from History
2. Different models of Governing system and their comparative study

Unit III: Economic Development (18 hours)

1. Birth of Capitalism, Socialism, Marxism
2. Concept of development in pre-British, British and post British period- Barter, Jajmani
3. Idea of development in current context.
4. E. F. Schumacher's idea of development, Buddhist economics.

Gandhian idea of development. Swaraj and Decentralization.

PROJECT: Possible projects in this course could be

a) Interact with local communities and understand their issues.

b) Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.

c) Evaluation of technology in the context of its application. Social impact of technology. Environmental impact of technology. Evaluation from a holistic perspective.

Course Code: HSMC102-18	Course Title: PHILOSOPHY	3L:0T:0P	3Credits

Detailed Contents:

Unit 1:

The difference between knowledge (Vidya) and Ignorance (Avidya):

a. Upanishads;

b. Six systems orthodox and Heterodox Schools of Indian Philosophy.

c. Greek Philosophy:

Unit 2:

Origin of the Universe:

- NasidiyaSukta: "Who really knows?”
- Brhadaranyaka Upanishad; Chandogya Upanishad: Non-self, Self, real and unreal.
- Taittiriya Upanishad: SikshaValli.
- Plato’s Symposium: Lack as the source of desire and knowledge.
- Socratic’s method of knowledge as discovery.
- Language: Word as root of knowledge (Bhartrahari’sVakyapadiyam)
- Fourteen Knowledge basis as a sources of Vidya: Four Vedas; Six auxiliary sciences (Vedangas); Purana, Nyaya, Mimamsa and Dharma Sastras.

Unit 3:

Knowledge as Power: Francis Bacon. Knowledge as both power and self-realization in Bagavad Gita.

Unit 4:

Knowledge as oppression: M. Foucault. Discrimination between Rtam and Satyam in Indian Philosophy.

Unit 5:

Knowledge as invention: Modern definition of creativity; scientific activity in the claim that science invents new things at least through technology.

Unit 6:

Knowledge about the self, transcendental self; knowledge about society, polity and nature.

Unit 7:

Knowledge about moral and ethics codes.

Unit 8:

Tools of acquiring knowledge: Tantrayuktis, a system of inquiry (Caraka, Sushruta, Kautilya, Vyasa)

READINGS

1. Copleston, Frederick, History of Philosophy, Vol. 1.Great Britain: Continuum.
2 Hiriyanna, M. Outlines of Indian Philosophy, MotilalBanarsidass Publishers; Fifth Reprint edition (2009)
3 Sathaye, Avinash, Translation of NasadiyaSukta
4. Ralph T. H. Griffith. The Hymns of the Ṛgveda. MotilalBanarsidass: Delhi: 1973.
5. Raju, P. T. Structural Depths of Indian Thought, Albany: State University of New York Press.
6. Plato, Symposium, Hamilton Press.
7. KautilyaArtha Sastra. Penguin Books, New Delhi.
8. Bacon, Nova Orgum
9. Arnold, Edwin. The Song Celestial.
10. Foucault, Knowledge/Power.
11. Wildon, Anthony, System of Structure.
12. Lele, W.K. The Doctrine of Tantrayukti. Varanasi: Chowkamba Series.

13. Dasgupta, S. N. History of Indian Philosophy, MotilalBanasidas, Delhi.

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14. Passmore, John, Hundred Years of Philosophy, Penguin.

ASSESSMENT (indicative only):

Ask students to do term papers, for example, writing biographical details of founders, sustainers, transmitters, modifiers, rewriters; translating monographs of less known philosophers such as K. C. Bhattacharys, Daya Krishna, Gopinath Bhattacharya; comparative study of philosophical system such as MadhyasthaDarshan.

OUTCOME OF THE COURSE:

Students will develop strong natural familiarity with humanities along with right understanding enabling them to eliminate conflict and strife in the individual and society. Students shall be able to relate philosophy to literature, culture, society and lived experience can be considered.

BTCS401-18	**Discrete Mathematics**	**3L:1T:0P**	**4 Credits**

Detailed contents:

Module 1:

Sets, Relation and Function: Operations and Laws of Sets, Cartesian Products, Binary Relation, Partial Ordering Relation, Equivalence Relation, Image of a Set, Sum and Product of Functions, Bijective functions, Inverse and Composite Function, Size of a Set, Finite and infinite Sets, Countable and uncountable Sets, Cantor's diagonal argument and The Power Set theorem, Schroeder-Bernstein theorem.

Principles of Mathematical Induction: The Well-Ordering Principle, Recursive definition, The Division algorithm: Prime Numbers, The Greatest Common Divisor: Euclidean Algorithm, The Fundamental Theorem of Arithmetic. CO1, CO2

Module 2:

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination. CO3

Module 3:

Propositional Logic: Syntax, Semantics, Validity and Satisfiability, Basic Connectives and Truth Tables, Logical Equivalence: The Laws of Logic, Logical Implication, Rules of Inference, The use of Quantifiers. **Proof Techniques:** Some Terminology, Proof Methods and Strategies, Forward Proof, Proof by Contradiction, Proof by Contraposition, Proof of Necessity and Sufficiency. CO3, CO4

Module 4:

Algebraic Structures and Morphism: Algebraic Structures with one Binary Operation, Semi Groups, Monoids, Groups, Congruence Relation and Quotient Structures, Free and Cyclic Monoids and Groups, Permutation Groups, Substructures, Normal Subgroups, Algebraic Structures with two Binary Operation, Rings, Integral Domain and Fields. Boolean Algebra and Boolean Ring, Identities of Boolean Algebra, Duality, Representation of Boolean Function, Disjunctive and Conjunctive Normal Form CO4

Module 5:

Graphs and Trees: Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances. CO5

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Suggested books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill

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2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

Suggested reference books:

1. J.P. Tremblay and R. Manohar, Discrete Mathematical Structure and Its Application to Computer Science", TMG Edition, TataMcgraw-Hill
2. Norman L. Biggs, Discrete Mathematics, 2nd Edition, Oxford University Press. Schaum's Outlines Series, Seymour Lipschutz, Marc Lipson,
3. Discrete Mathematics, Tata McGraw - Hill

Course Outcomes

1. To be able to express logical sentence in terms of predicates, quantifiers, and logical connectives
2. To derive the solution for a given problem using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. To evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. To develop the given problem as graph networks and solve with techniques of graph theory.

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Fifth Semester

BTES501-18	**Enterprise Resource Planning**	**3L:0T:0P**	**3 Credits**

Course Details:

UNIT 1 INTRODUCTION

ERP: An Overview, Enterprise – An Overview, Benefits of ERP, ERP and Related Technologies, Business Process Reengineering (BPR), Data Warehousing, Data Mining, OLAP, SCM [9hrs., CO1]

UNIT II ERP IMPLEMENTATION

ERP Implementation Lifecycle, Implementation Methodology, Hidden Costs, Organizing the Implementation, Vendors, Consultants and Users, Contracts with Vendors, Consultants and Employees, Project Management and Monitoring [9hrs., CO2]

UNIT III THE BUSINESS MODULES

Business modules in an ERP Package, Finance, Manufacturing, Human Resources, Plant Maintenance, Materials Management, Quality Management, Sales and Distribution [9hrs., CO3]

UNIT IV THE ERP MARKET

ERP Market Place, SAP AG, Peoplesoft, Baan, JD Edwards, Oracle, QAD, SSA [9hrs., CO4]

UNIT V ERP – PRESENT AND FUTURE

Turbo Charge the ERP System, EIA, ERP and e-Commerce, ERP and Internet, Future Directions

[6hrs., CO1]

TEXT BOOK

1. Alexis Leon, "ERP Demystified", Tata McGraw Hill, New Delhi, 2000

REFERENCES

1. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology, USA, 2001.

2. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning – Concepts and Practice", PHI, New Delhi, 2003

Course outcomes: The students at the end will be able;

CO1: To know the basics of ERP

CO2: To understand the key implementation issues of ERP

CO3: To know the business modules of ERP

CO4: To be aware of some popular products in the area of ERP

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Course Code: BTCS501-18	**Course Title:** Database Management Systems	**3L:0T:0P**	**3Credits**

<u>Detailed Contents:</u>

Module 1: Database system architecture

Data Abstraction, Data Independence, Data Definition Language (DDL), Data Manipulation Language (DML). Data models: Entity-relationship model, network model, relational and object oriented Data models, integrity constraints, data manipulation operations.

[7hrs] (CO1,2)

Module 2: Relational query languages

Relational algebra, Tuple and domain relational calculus, SQL3, DDL and DML constructs, Open source and Commercial DBMS - MYSQL, ORACLE, DB2, SQL server. Relational database design: Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design. Query processing and optimization: Evaluation of relational algebra expressions, Query equivalence, Join strategies, Query optimization algorithms. **[10hrs] (CO2,4)**

Module 3:

Storage strategies, Indices, B-trees, hashing. **[3hrs] (CO3)**

Module 4: Transaction processing

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery. **[6hrs] (CO3)**

Module 5: Database Security

Authentication, Authorization and access control, DAC, MAC and RBAC models, Intrusion detection, SQL injection. **[8hrs] (CO 4,5)**

Module 6: Advanced Topics

Object oriented and object relational databases, Logical databases, Web databases, Distributed databases. **[8hrs] (CO 5)**

<u>Course Outcomes:</u>

At the end of study the student shall be able to:

CO1: write relational algebra expressions for a query and optimize the Developed expressions
CO2: design the databases using ER method and normalization.
CO3: construct the SQL queries for Open source and Commercial DBMS-MYSQL, ORACLE, and DB2.
CO4: determine the transaction atomicity, consistency, isolation, and durability.
CO5: Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Text Books:

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1. “Database System Concepts”, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

Reference Books:

1. “Principles of Database and Knowledge–Base Systems”, Vol1 by J. D. Ullman, Computer Science Press.
2. “Fundamentals of Database Systems”, 5th Edition by R. Elmasri and S. Navathe, Pearson Education.
3. “Foundations of Databases”, Reprint by Serge Abiteboul, Richard Hull, Victor Vianu, Addison-Wesley.

- -

Course Code: BTCS502-18	**Course Title:** Formal Language & Automata Theory	**3L:1T:0P**	**3Credits**	**42 Hours**

Detailed Contents

Module 1: Introduction

Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. **[3hrs] (CO1)**

Module 2: Regular languages and finite automata:

Regular expressions and languages, deterministic finite automata (DFA) and equivalence with regular expressions, nondeterministic finite automata (NFA) and equivalence with DFA, regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata. **[8hrs] (CO2)**

Module 3: Context-free languages and pushdown automata

Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs. **[8hrs] (CO3)**

Module 4: Context-sensitive languages

Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. **[5hrs] (CO4)**

Module 5: Turing machines

The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators. **[8hrs] (CO 5)**

Module 6: Undecidability & Intractablity:

Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

Intractablity: Notion of tractability/feasibility. The classes NP and co-NP, their importance. Polynomial time many-one reduction. Completeness under this reduction. Cook-Levin theorem:

NP-completeness of propositional satisfiability, other variants of satisfiability. NP-complete problems from other domains: graphs (clique, vertex cover, independent sets, Hamiltonian cycle), number problem (partition), set cover **[12hrs] (CO5)**

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Course Outcomes: The student will be able to:

CO1: Write a formal notation for strings, languages and machines.

CO2: Design finite automata to accept a set of strings of a language.

CO3: Design context free grammars to generate strings of context free language .

CO4: Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

CO5: Distinguish between computability and non-computability and Decidability and undecidability.

Text Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Reference Books:

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

Course Code: BTCS503-18	**Course Title:** Software Engineering	**3L:1T:0P**	**3Credits**	**42 Hours**

Detailed Contents:

Module 1:

Evolution and impact of Software engineering, software life cycle models: Waterfall, prototyping, Evolutionary, and Spiral models. Feasibility study, Functional and Non-functional requirements, Requirements gathering, Requirements analysis and specification.

[10hrs] (CO 1)

Module 2:

Basic issues in software design, modularity, cohesion, coupling and layering, function-oriented software design: DFD and Structure chart, object modeling using UML, Object-oriented software development, user interface design. Coding standards and Code review techniques.

[8hrs] (CO2)

Module 3:

Fundamentals of testing, White-box, and black-box testing, Test coverage analysis and test case design techniques, mutation testing, Static and dynamic analysis, Software reliability metrics, reliability growth modeling. **[10hrs] (CO 3)**

Module 4:

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Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management **[8hrs]** (CO4)

Module 5:

ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

[6hrs] (CO5)

Text Books:

1. Roger Pressman, "Software Engineering: A Practitioners Approach,(6th Edition), McGraw Hill, 1997.

Reference Books:

1. Sommerville, "Software Engineering, 7th edition", Adison Wesley, 1996.
2. Watts Humphrey, "Managing software process", Pearson education, 2003.
3. James F. Peters and Witold Pedrycz, " Software Engineering – An Engineering Approach", Wiley.
4. Mouratidis and Giorgini. "Integrating Security and Software Engineering–Advances and Future", IGP. ISBN – 1-59904-148-0.
5. Pankaj Jalote, "An integrated approach to Software Engineering", Springer/Narosa.
6. Fundamentals of Software Engineering by Rajib Mall, – PHI-3rd Edition, 2009.

Course Outcomes:

At the end of the course the student should be able to:

CO 1: Students should be able to identify the need for engineering approach to software development and various processes of requirements analysis for software engineering problems.

CO 2: Analyse various software engineering models and apply methods for design and development of software projects.

CO 3: Work with various techniques, metrics and strategies for Testing software projects.

CO 4: Identify and apply the principles, processes and main knowledge areas for Software Project Management

CO 5: Proficiently apply standards, CASE tools and techniques for engineering software projects

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Course Code: BTCS 504-18	**Course Title:** Computer Networks	**3L:1T:0P**	**3Credits**	**42 Hours**

Detailed Contents:

Module 1: Data Communication Components

Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Connecting LAN and Virtual LAN, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division, Concepts on spread spectrum.

[8hrs] (CO1)

Module 2: Data Link Layer and Medium Access Sub Layer

Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ, Sliding Window, Piggybacking, Random Access, Multiple access protocols -Pure ALOHA, Slotted ALOHA, CSMA/CDCDMA/CA. **[10 hrs] (CO2)**

Module 3: Network Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. **[8 hrs] (CO3)**

Module 4: Transport Layer

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm. **[8 hrs] (CO3)**

Module 5: Application Layer

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography.

[8 hrs] (CO4)

Course Outcomes: The student will be able to:

CO1: Explain the functions of the different layer of the OSI Protocol;

CO2:. Describe the function of each block of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs);

CO3: Develop the network programming for a given problem related TCP/IP protocol; &

CO4: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Text Books:

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.

Reference Books:

1. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

2. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
3. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

Course Code: BTCS505-18	**CourseTitle:** Database management System lab	**0L:0T:4P**	**2Credits**

List of Experiments:

Task 1: Introduction to SQL and installation of SQL Server / Oracle.

Task 2: Data Types, Creating Tables, Retrieval of Rows using Select Statement, Conditional Retrieval of Rows, Alter and Drop Statements.

Task 3: Working with Null Values, Matching a Pattern from a Table, Ordering the Result of a Query, Aggregate Functions, Grouping the Result of a Query, Update and Delete Statements.

Task 4: Set Operators, Nested Queries, Joins, Sequences.

Task 5: Views, Indexes, Database Security and Privileges: Grant and Revoke Commands, Commit and Rollback Commands.

Task 6: PL/SQL Architecture, Assignments and Expressions, Writing PL/SQL Code, Referencing Non-SQL parameters.

Task 7: Stored Procedures and Exception Handling.

Task 8: Triggers and Cursor Management in PL/SQL.

***Suggested Tools* –** MySQL, DB2, Oracle, SQL Server 2012, Postgre SQL, SQL lite

Course Outcomes:

CO1: This practical will enable students to retrieve data from relational databases using SQL.

CO2: students will be able to implement generation of tables using datatypes

CO3: Students will be able to design and execute the various data manipulation queries.

CO4: Students will also learn to execute triggers, cursors, stored procedures etc.

Course Code: BTCS506-18	**Course Title:** Software Engineering Lab	**0L:0T:2P**	**1 Credits**

List of Experiments:

Task 1: Study and usage of OpenProj or similar software to draft a project plan

Task 2: Study and usage of OpenProj or similar software to track the progress of a project

Task 3: Preparation of Software Requirement Specification Document, Design Documents and Testing Phase

Task 4: related documents for some problems
Task 5: Preparation of Software Configuration Management and Risk Management related documents
Task 6: Study and usage of any Design phase CASE tool
Task 7: To perform unit testing and integration testing
Task 8: To perform various white box and black box testing techniques
Task 9: Testing of a web site

Suggested Tools **-** Visual Paradigm, Rational Software Architect. Visio, Argo UML, Rational Application Developer etc. platforms.

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Course Code: BTCS507-18	**Course Title:** Computer Networks Lab	**0L:0T:2P**	**1 Credits**

List of Experiments:

Task 1: To study the different types of Network cables and network topologies.
Task 2: Practically implement and test the cross-wired cable and straight through cable using clamping tool and network lab cable tester.
Task 3: Study and familiarization with various network devices.
Task 4: Familiarization with Packet Tracer Simulation tool/any other related tool.
Task 5: Study and Implementation of IP Addressing Schemes
Task 6: Creation of Simple Networking topologies using hubs and switches
Task 7: Simulation of web traffic in Packet Tracer
Task 8: Study and implementation of various router configuration commands
Task 9: Creation of Networks using routers.
Task 10: Configuring networks using the concept of subnetting
Task 11: Practical implementation of basic network command and Network configuration commands like ping, ipconfig, netstat, tracert etc. for troubleshooting network related problems.
Task 12: Configuration of networks using static and default routes.

Course Outcomes:
The students will be able to:

CO1: Know about the various networking devices, tools and also understand the implementation of network topologies;
CO2: Create various networking cables and know how to test these cables;
CO3: Create and configure networks in packet trace rtool using various network devices and topologies;
CO4: Understand IP addressing and configure networks using the subnet in;
CO5: Configure routers using various router configuration commands.

Suggested Tools **- NS2/3, Cisco packet tracer, Netsim etc.**.

ELECTIVES- I

Course Code: BTCS 510-18	**Course Title:** Programming in Python	**3L:0T:0P**	**3 Credits**	**42 Hours**

Detailed Contents:

Module 1:
Python Basics, Objects- Python Objects, Standard Types, Other Built-in Types, Internal Types, Standard Type Operators, Standard Type Built-in Functions, Categorizing the Standard Types, Unsupported Types Numbers - Introduction to Numbers, Integers, Floating Point Real Numbers, Complex Numbers, Operators, Built-in Functions, Related Modules Sequences - Strings, Lists, and Tuples, Mapping and Set Types.

[8hrs] (CO1)

Module 2:
FILES: File Objects, File Built-in Function [open()], File Built-in Methods, File Built-in Attributes, Standard Files, Command-line Arguments, File System, File Execution, Persistent Storage Modules, Related Modules
Exceptions: Exceptions in Python, Detecting and Handling Exceptions, Context Management, *Exceptions as Strings, Raising Exceptions, Assertions, Standard Exceptions, *Creating Exceptions, Why Exceptions (Now)?, Why Exceptions at All?, Exceptions and the sys Module, Related Modules
Modules: Modules and Files, Namespaces, Importing Modules, Importing Module Attributes, Module Built-in Functions, Packages, Other Features of Modules.

[10hrs] (CO1,2)

Module 3:
Regular Expressions: Introduction, Special Symbols and Characters, Res and Python Multithreaded Programming: Introduction, Threads and Processes, Python, Threads, and the Global Interpreter Lock, Thread Module, Threading Module, Related Modules.

[8hrs] (CO 2,3)

Module 4:
GUI Programming: Introduction, Tkinter and Python Programming, Brief Tour of Other GUIs, Related Modules and Other GUIs
WEB Programming: Introduction, Wed Surfing with Python, Creating Simple Web Clients, Advanced Web Clients, CGI-Helping Servers Process Client Data, Building CGI Application Advanced CGI, Web (HTTP) Servers. **[10hrs] (CO 4,6)**

Module 5:
Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object Relational Managers (ORMs), Related Modules. **[6 hrs] (CO5)**

Text Books:

1. Core Python Programming, Wesley J. Chun, Second Edition, Pearson.

Course Outcomes:

The students should be able to:

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CO1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO2: Demonstrate proficiency in handling Strings and File Systems.
CO3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
CO4: Interpret the concepts of Object-Oriented Programming as used in Python.
CO5: Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Course Code: BTCS 513-18	**Course Title:** Programming in Python Lab	**0L:0T:2P**	**1 Credits**	**2 Hours/ week**

Prerequisites: Students should install Python.

<u>List of Experiments:</u>

Task 1: Write a program to demonstrate different number data types in Python.
Task 2: Write a program to perform different Arithmetic Operations on numbers in Python.
Task 3: Write a program to create, concatenate and print a string and accessing sub-string from a given string.
Task 4: Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
Task 5: Write a program to create, append, and remove lists in python.
Task 6: Write a program to demonstrate working with tuples in python.
Task 7: Write a program to demonstrate working with dictionaries in python.
Task 8: Write a python program to find largest of three numbers.
Task 9: Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]
Task 10: Write a Python program to construct the following pattern, using a nested for loop *

```
*
* *
* * *
* * * *
* * *
* *
*
*
```

Task 11: Write a Python script that prints prime numbers less than 20.
Task 12: Write a python program to find factorial of a number using Recursion.
Task 13: Write a program that accepts the lengths of three sides of a triangle as inputs. The program output should indicate whether or not the triangle is a right triangle (Recall from the Pythagorean Theorem that in a right triangle, the square of one side equals the sum of the squares of the other two sides).
Task 14: Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
Task 15: Write a python program to define a module and import a specific function in that module to another program.

Task 16: Write a script named copyfile.py. This script should prompt the user for the names of two text files. The contents of the first file should be input and written to the second file.

Task 17: Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
Task 18: Write a Python class to convert an integer to a roman numeral.
Task 19: Write a Python class to implement pow(x, n)
Task 20: Write a Python class to reverse a string word by word.

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c**Course Code:** BTCS521-	**Course Title:** Computational Biology	**3L:0T:0P**	**3 Credits**	**42 Hours**

Detailed Contents:

Module 1: Introduction

Nature and scope of life science: Branches of life sciences, Characteristics of life, Levels of Organization, Origin of life, Biochemical evolution- evolution of Proteins and Nucleotide. ***Cell Biology***: The cell as basic unit of life- Prokaryotic cell and Eukaryotic cell, Cell Structure and Function- cell membrane, cell organelles, Cell Division; Mitosis & Meiosis. ***Cell Energetics***: Laws of Thermodynamics, Photosynthesis, Anaerobic & aerobic respiration, Structure and function of mitochondria, respiratory pathways: Glycolysis, Kreb's Cycle, Electron transport chain.

[10hrs] (CO)

Module 2: More about RNA and DNA

Chromosome-Genome-Genes-Databases: Bio-molecules- DNA, RNA, Protein and amino acids, Chargaff's Rules, GC content.
Central Dogma: Replication, Transcription, Translation, Post transcriptional & post translational modifications, RNA processing, RNA splicing and RNA editing. Sense/coding and anti-sense/template strands, Genetic code. Introduction to DNA and Protein sequencing.

[10hrs] (CO)

Module 3: Proteins

Proteins and Databases: Protein structure and function, Protein Primary structure, Amino acid residues, Secondary, Tertiary, Quaternary Structure of Protein, Protein sequence databases- SwissProt/ TrEMBL, PIR, Sequence motif databases -Pfam, PROSITE, Protein structure databases. **[8hrs] (CO)**

Module 4: Computation and Biology

Molecular computational biology: Gene prediction, sequencing genomes, similarity search, restriction mapping, ***Sequence Analysis***: Principles and its uses, Hidden Markov models for sequence analysis. Introduction of Markov Chain and Hidden Markov models. Forward backward algorithm, Viterbi and Baum-Welch algorithms,

[14hrs] (CO)

Course Outcomes:

The student will be able to:

CO1: Understand the basic of cell structure, divisions involved in reproduction of a cell, and its generic functionality;
CO2: Recognize the base line elements of a RNA and DNA; including fundamental behind their complex structure;
CO3: Comprehend primary structure of the protein and various related data-sets.

CO4: Demonstrate the concept of gene sequence alignment and simulate various related algorithms for the same.

Text books

1. Pevzner, P. A., Computational Molecular Biology, PHI Learning Pvt. Ltd, ISBN-978-81-203-2550-0.
2. Ghosh, Z. and Mallick, B., Bioinformatics Principles and Applications (2008) Oxford University Press ISBN 9780195692303
3. Mount, D. W., Bioinformatics – sequence and genome analysis.

Reference Books

1. Devasena, T. (2012). Cell Biology. Published by Oxford University Press.
2. Fall, C.P., Marland, E.S., Wagner, J.M., Tyson, J.J.(2002). Computational Cell Biology. Springer
3. Becker, W. M., Kleinsmith, L. J., Hardin, J., & Raasch, J. (2003). The world of the cell (Vol. 6). San Francisco: Benjamin Cummings.
4. Rastogi, S. C. (2005). Cell biology. New Age International.
5. Reece, J. B., Taylor, M. R., Simon, E. J., & Dickey, J. (2009). Biology: concepts & connections (Vol. 3, p. 2). Pearson/Benjamin Cummings.

Course Code: BTCS523-18	**Course Title:** Computational Biology Lab	**0L:0T:2P**	**1 Credits**	**2 Hours/ week**

List of Experiments:

Task 1: Introduction of Bio Python, Various Packages and its Installation.

Task 2,3: Parsing sequence file formats
- Sequences and Alphabets
- Sequences act like strings
- Slicing a sequence
- Turning Seq objects into strings
- Concatenating or adding sequences
- Changing case
- Nucleotide sequences and (reverse) complements
- Transcription
- Translation

Task 4,5: Sequence annotation objects
- The SeqRecord object
- Creating a SeqRecord
  - SeqRecord objects from scratch
  - SeqRecord objects from FASTA files
  - SeqRecord objects from GenBank files
- Feature, location and position objects
  - SeqFeature objects
  - Positions and locations
  - Sequence described by a feature or location

Task 6,7,8: BLAST
- Running BLAST over the Internet
- Running BLAST locally

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Introduction
Standalone NCBI BLAST+
Other versions of BLAST

- Parsing BLAST output
- The BLAST record class
- Dealing with PSI-BLAST
- Dealing with RPS-BLAST

BLAST and other sequence search tools

- The SearchIO object model
  - QueryResult
  - Hit
  - HSP
  - HSPFragment
- A note about standards and conventions
- Reading search output files
- Dealing with large search output files with indexing
- Writing and converting search output files

Task 9,10: Multiple Sequence Alignment objects

- Parsing or Reading Sequence Alignments
  - Single Alignments
  - Multiple Alignments
  - Ambiguous Alignments
- Writing Alignments
  - Converting between sequence alignment file formats
  - Getting your alignment objects as formatted strings
- Manipulating Alignments
  - Slicing alignments
  - Alignments as arrays

Task 11,12,13: Sequence motif analysis using Bio.motifs

- Motif objects
  - Creating a motif from instances
  - Creating a sequence logo
- Reading motifs
  - JASPAR
  - MEME
  - TRANSFAC
- Writing motifs
- Position-Weight Matrices

Quick Reference:
http://biopython.org/DIST/docs/tutorial/Tutorial.html#htoc106
https://biopython.readthedocs.io/en/latest/Tutorial/chapter_seq_objects.html

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Course Code: BTCS 515-18	**Course Title:** Computer Graphics	**3L:0T:0P**	**3 Credits**	**45 Hours**

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Detailed Contents:

Module 1:
Overview of Computer Graphics: Basics of Computer Graphics, Applications, Video Display devices, Raster–Scan displays, Random–Scan displays, Color CRT Monitors, Flat–Panel Displays; Video Controller, Display Processor, Common Graphic Input and Output devices, Graphic File Formats, Graphics Software's.

[6hrs] (CO1)

Module 2:
Output Primitives: Line Drawing, DDA, Bresenham Line Algorithm; Mid-Point Line Algorithm, Bresenham Circle Algorithm, Midpoint Circle drawing algorithms; Midpoint Ellipse Algorithm; Flood and Boundary Filling.

[6hrs] (CO1)

Module 3:
Two-Dimensional Geometric Transformation: Translation, Rotation, Scaling, Reflection, Shearing, Matrix representations; Composite transformations.

[6hrs] (CO1,2)

Module 4:
Two-Dimensional Viewing: Viewing coordinate reference frame; Window to Viewport coordinate transformation. Point Clipping, Line Clipping, text Clipping; Cohen–Sutherland and Liang–Barskey Algorithms for line clipping; Sutherland–Hodgeman algorithm for polygon clipping.

[6hrs](CO2)

Module 5:
Three Dimensional Transformations & Viewing: Translation, Rotation, Scaling, Reflection and composite transformations. Parallel and Perspective Projections, Viewing Transformation: View Plan, View Volumes and Clipping.

[6hrs] (CO2)

Module 6:
3 D Graphics and Visibility: Plane projections and its types, Vanishing points, Specification of a 3D view. Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.

[6hrs] (CO2,3)

Module 7:
Color Models: Properties of Light, Intuitive Color Concepts, concepts of chromaticity, RGB Color Model, CMY Color Model, HLS and HSV Color Models, Conversion between RGB and CMY color Models, Conversion between HSV and RGB color models, Color Selection and Applications.

[6hrs] (CO2,3)

Module 8:
Animation: Graphics Design of Animation sequences, General Computer Animation Functions Introduction to Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

[3hrs] (CO3)

Reference Books:

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1. D. Hearn and M.P. Baker, Computer Graphics: C version, 2nd Edition, PHI, 2004.
2. D.F. Rogers, Mathematical Elements for Graphics, 2nd Edition., McGraw Hill, 2004.

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3. J.D. Foley et al, Computer Graphics, Principles and Practices, 2nd Edition, Addison Wasley, 2004.
4. Roy A. Plastock, Gordon Kalley, Computer Graphics, Schaum's Outline Series, 1986.

Course Outcomes: The students shall be able to:
CO1: Understand about fundamentals of Graphics to enable them to design animated scenes for virtual object creations.
CO2: Make the student present the content graphically.
CO3: Work in computer aided design for content presentation for better analogy data with pictorial representation

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Course Code: BTCS 518-18	**Course Title:** Computer Graphics Lab	**0L:0T:4P**	**2 Credits**	**2 Hours/ week**

List of Experiments:

Task 1: WAP to draw different geometric structures using different functions.
Task 2: Implement DDA line generating algorithm.
Task 3: Implement Bresenham's line generating algorithm.
Task 4: Implement Mid-point circle line generating algorithm.
Task 5: Implementation of Bresenham's circle drawing algorithm.
Task 6: Implementation of mid-point circle generating Algorithm.
Task 7: Implementation of ellipse generating Algorithm.
Task 8: WAP of color filling the polygon using Boundary fill and Flood fill algorithm.
Task 9: To translate an object with translation parameters in X and Y directions.
Task 10: To scale an object with scaling factors along X and Y directions.
Task 11: Program of line clipping using Cohen-Sutherland algorithm.
Task 12: To perform composite transformations of an object.
Task 13: To perform the reflection of an object about major.

Course Code: BTCS 520-18	**Course Title:** Web Technologies	**3L:0T:0P**	**3 Credits**	**42 Hours**

Detailed Contents:

Module 1:
Introduction: History and evolution of Internet protocols, Internet addressing, Internet Service Provider (ISP), Introduction to WWW, DNS, URL, HTTP, HTTPS, SSL, Web browsers, Cookies, Web servers, Proxy servers, Web applications. Website design principles, planning the site and navigation. [6 hrs][CO1]

Module 2:

HTML and DHTML: Introduction to HTML and DHTML, History of HTML, Structure of HTML Document: Text Basics, Structure of HTML Document: Images, Multimedia, Links,

Audio, Video, Table and Forms, Document Layout, HTML vs. DHTML, Meta tags, Browser architecture and Website structure. Overview and features of HTML5.

[7 hrs][CO2]

Module 3:

Style Sheets: Need for CSS, Introduction to CSS, Basic syntax and structure, Types of CSS – Inline, Internal and External CSS style sheets.CSS Properties - Background images, Colors and properties,Text Formatting, Margin, Padding, Positioning etc., Overview and features of CSS3.

[7 hrs][CO3]

Module 4:

Java Script: Introduction, JavaScript's history and versions, Basic syntax, Variables, Data types, Statements, Operators, Functions, Arrays, Objects, dialog boxes, JavaScript DOM.

[7 hrs][CO4]

Module 5:

PHP and MySQL: Introduction and basic syntax of PHP, Data types, Variables,Decision and looping with examples, String, Functions, Array, Form processing, Cookies and Sessions, E-mail, PHP-MySQL: Connection to server.

[7 hrs][CO5]

Module 6:

Ajax and JSON: AJAX Introduction, AJAX Components, Handling Dynamic HTML with Ajax, Advantages & disadvantages, HTTP request, XMLHttpRequest Server Response.

JSON– Syntax, Schema, Data types, Objects, Reading and writing JSON on client and server. Using JSON in AJAX applications. [8 hrs][CO6]

Students shall be able to:

CO1. Understand and apply the knowledge of web technology stack to deploy various web services.
CO2. Analyze and evaluate web technology components for formulating web related problems.
CO3. Design and develop interactive client server internet application that accommodates user specific requirements and constraint analysis.
CO4. Program latest web technologies and tools by creating dynamic pages with an understanding of functions and objects.
CO5. Apply advance concepts of web interface and database to build web projects in multidisciplinary environments.
CO6. Demonstrate the use of advance technologies in dynamic websites to provide performance efficiency and reliability for customer satisfaction.

<u>Text Books</u>:

1. Jeffrey C. Jackson, “Web Technologies: A Computer Science Perspective”, PearsonEducation

2. Rajkamal, “Internet and Web Technology”, Tata McGraw Hill
3. Ray Rischpater, “JavaScript JSON Cookbook”, Packt Publishing.
4. Ivan Bayross, “Web Enabled Commercial Application Development using HTML, DHTML JavaScript, Perl, CGI”, BPB Publications.
5. Peter Moulding, “PHP Black Book”, Coriolis.

Course Code: BTCS 522-18	**Course Title:** Web Technologies Lab	**0L:0T:2P**	**1 credits**	**2 Hours/ week**

<u>List of Experiments:</u>

1. Configuration and administration Apache Web Server.
2. Develop an HTML page to demonstrate the use of basic HTML tags, Link to different HTML page and also link within a page, insertion of images and creation of tables.
3. Develop a registration form by using various form elements like input box, text area, radio buttons, check boxes etc.
4. Design an HTML page by using the concept of internal, inline, external style sheets.
5. Create an HTML file to implement the styles related to text, fonts, links using cascading style sheets
6. Create an HTML file to implement the concept of document object model using JavaScript
7. Create an HTML page including JavaScript that takes a given set of integer numbers and shows them after sorting in descending order.
8. Write an HTML page including any required JavaScript that takes a number from one text field in the range of 0 to 999 and shows it in another text field in words. If the number is out of range, it should show “out of range” and if it is not a number, it should show “not a number” message in the result box.
9. Create a PHP file to print any text using variable.
10. Demonstrate the use of Loops and arrays in PHP
11. Create a PHP file using GET and POST methods.
12. A simple calculator web application that takes two numbers and an operator (+, -, /, * and %) from an HTML page and returns the result page with the operation performed on the operands.
13. Implement login page contains the user name and the password of the user to authenticate with Session using PHP and MySQL, also implement this with the help of PHP-Ajax.
14. A web application for implementation:
    a. The user is first served a login page which takes user’s name and password. After submitting the details the server checks these values against the data from a database and takes the following decisions.
    b. If name and password matches, serves a welcome page with user’s full name.
    c. If name matches and password doesn’t match, then serves “password mismatch” page
    d. If name is not found in the database, serves a registration page, where user’s full name is asked and on submitting the full name, it stores, the login name, password and full name in the database (hint: use session for storing the submitted login name and password)
15. Demonstrate the use of Ajax and JSON Technologies in programming examples.

16. Demonstrate the use of web site designing tools such as Joomla, WordPress.
17. Implement at least one minor project using different technologies mentioned in theory of the

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subject.

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Sixth Semester

Course Code: BTCS601-18	**Course Title : Compiler Design**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: Unit I Introduction to Compilers:
Structure of a compiler – Lexical Analysis – Role of Lexical Analyzer – Input Buffering – Specification of Tokens – Recognition of Tokens – Lex – Finite Automata – Regular Expressions to Automata – Minimizing DFA. **[8 hrs., CO 1]**

Unit II :Syntax Analysis:
Role of Parser – Grammars – Error Handling – Context-free grammars – Writing a grammar, Top-Down Parsing – General Strategies Recursive Descent Parser – Predictive Parser-LL(1) Parser-Shift Reduce Parser-LR Parser-LR (0) Item Construction of SLR Parsing Table - Introduction to LALR Parser – Error Handling and Recovery in Syntax Analyzer-YACC.
[8 hrs., CO 2]

Unit III : Intermediate Code Generation:
Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Intermediate Languages: Syntax Tree, Three Address Code, Types and Declarations, Translation of Expressions, Type Checking. **[8 hrs., CO 3]**

Unit IV: Run-Time Environment and Code Generation:

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management – Issues in Code Generation – Design of a simple Code Generator.
[6 hrs., CO 4]

Unit V: Code Optimization:
Principal Sources of Optimization – Peep-hole optimization – DAG- Optimization of Basic Blocks-Global Data Flow Analysis – Efficient Data Flow Algorithm. **[6 hrs., CO 5]**

Course Outcomes:
After undergoing this course, the students will be able to:

CO1: Build concepts on lexical analysis.

CO2: Understand strategies of syntax analysis.

CO3: Learn techniques of Intermediate code generation.

CO4: Undestand code design issues and design code generator.

CO5: Design and develop optimized codes.

Suggested Readings/ Books:

1. A.V. Aho, Monica, R.Sethi, J.D.Ullman, “Compilers, Principles, Techniques and Tools”, Second Edition, Pearson Education/Addison Wesley, 2009.

2. Andrew W. Appel, “Modern Compiler Implementation in Java”, Second Edition, 2009.
3. J.P. Tremblay and P.G. Sorrenson, “The Theory and Practice of Compiler Writing”, McGraw Hill, 1985.

Course Code: BTCS604-18	**Course Title: Compiler Design Lab**	**L:0;T:0; 2P**	**1Credits**

Sr. No.	No. List of Experiments
1	Design a lexical analyser for given language and the lexical analyser should ignore redundant spaces, tabs and new lines. It should also ignore comments. Although the syntax specification states that identifiers can be arbitrarily long, you may restrict the length to some reasonable value. Simulate the same in C language.
2	Write a C program to identify whether a given line is a comment or not.
3	Write a C program to recognize strings under 'a', 'a*b+', 'abb'.
4	Write a C program to test whether a given identifier is valid or not.
5	Write a C program to simulate lexical analyzer for validating operators.
6	Implement the lexical analyzer using JLex, flex or other lexical analyzer generating tools.
7	Write a C program for implementing the functionalities of predictive parser for the mini language specified in Note 1.
8	a) Write a C program for constructing of LL (1) parsing. b) Write a C program for constructing recursive descent parsing.
9	Write a C program to implement LALR parsing.
10	a) Write a C program to implement operator precedence parsing. b) Write a C program to implement Program semantic rules to calculate the expression that takes an expression with digits, + and * and computes the value.
11	Convert the BNF rules into YACC form and write code to generate abstract syntax tree for the mini language specified in Note 1.
12	Write a C program to generate machine code from abstract syntax tree generated by the parser. The instruction set specified in Note 2 may be considered as the target code.

Course Code:BTCS602-18	**Course Title : Artificial Intelligence**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: Introduction (3 Hours)

Concept of AI, history, current status, scope, agents, environments, Problem Formulations, Review
of tree and graph structures, State space representation, Search graph and Search tree.

[8hrs] (CO 1)

UNIT 2: Search Algorithms

Random search, Search with closed and open list, Depth first and Breadth first search, Heuristic search, Best first search, A* algorithm, Game Search.

[9hrs] (CO 2)

UNIT 3: Probabilistic Reasoning

Probability, conditional probability, Bayes Rule, Bayesian Networks- representation, construction and inference, temporal model, hidden Markov model.

[6hrs] (CO 3)

UNIT 4 Markov Decision process

MDP formulation, utility theory, utility functions, value iteration, policy iteration and partially observable MDPs. **[6hrs] (CO 4)**

UNIT 5 Reinforcement Learning

Passive reinforcement learning, direct utility estimation, adaptive dynamic programming, temporal difference learning, active reinforcement learning- Q learning**.**

[6hrs] (CO 5)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Build intelligent agents for search and games

CO2: Solve AI problems by learning various algorithms and strategies

CO3: Understand probability as a tool to handle uncertainity

CO4: Learning optimization and inference algorithms for model learning

CO5: Design and develop programs for an reinforcement agent to learn and act in a structured environment

Suggested Readings/ Books:

1. Stuart Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach" , 3rd Edition, Prentice Hall
2. Elaine Rich and Kevin Knight, "Artificial Intelligence", Tata McGraw Hill
3. Trivedi, M.C., "A Classical Approach to Artifical Intelligence", Khanna Publishing House, Delhi.
4. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India,
5. David Poole and Alan Mackworth, "Artificial Intelligence: Foundations for Computational Agents", Cambridge University Press 2010

Course Code: BTCS 605-18	**Course Title Artificial Intelligence Lab**	**L:0;T:0;2 P:**	**1 Credits**

Detailed List of Tasks:

1. Write a programme to conduct uninformed and informed search.
2. Write a programme to conduct game search.
3. Write a programme to construct a Bayesian network from given data.
4. Write a programme to infer from the Bayesian network.

5. Write a programme to run value and policy iteration in a grid world.

6. Write a programme to do reinforcement learning in a grid world

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ELECTIVE II

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Course Code: BTCS 606-18	**Course Title:** Simulation and Modeling	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT1: Introduction

Introduction to simulation and modeling, Application areas, System and system environment, Components of a system, Discrete and continuous systems, Basic model forms and its types, Discrete-event simulation, Steps in a simulation study, Simulation examples.[**4 hrs] (CO 1)**

UNIT2: General Principles

Concepts in discrete event simulation, Handling Stepped and Event-based Time in Simulations, Event scheduling/time advance algorithms, World views, List processing using dynamic allocation and linked list. **[4 hrs] (CO 1)**

UNIT 3: Statistical and Queuing Models in Simulation

Terms and concepts, Statistical models, Discrete and continuous distributions, Poisson distributions, Empirical distributions, Little's equation. Characteristics of queuing systems, Queuing notation, Long- Run measures of performance of queuing systems, Steady state behavior of infinite and finite calling population models, Use of network of queues.
[9 hrs] (CO 2)

UNIT 4 Random Number Generation

Pseudo random numbers, Techniques for generation of pseudo random numbers, Tests for random numbers, Random variate generation, Inverse Transform Technique- Exponential, Uniform, Weibull, Triangular distributions, Direct transformation for Normal and lognormal distributions. **[6hrs] (CO 2)**

UNIT 5 Input Modeling and Output Analysis of a Single Model

Data collection, Identifying the distribution of data - histograms and quantile plots, Parameter estimation, Goodness of fit tests applied to simulation inputs, Verification and validation of simulation models, Output analysis and measures of performance and estimation. **[6hrs] (CO 3)**

UNIT 6 Comparison and Evaluation of Alternative System Designs

Comparison of two system designs, Sampling with equal and unequal variances, Common random numbers, Comparison of several system designs, Linear regression, Random number assignment for regression. **[5 hrs] (CO 4)**

Course Outcomes:

After undergoing this course, the students will be able to

CO1: Discuss the fundamental elements of discrete-event simulation including statistical models, random processes, random variates, and inputs to simulation

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CO2: Analyze a real world problem and apply modelling methodologies to develop a discrete-event simulation model

CO3 Interpret discrete-event techniques for solving a simulation problem

CO4: Compare and evaluate alternative system designs using sampling and regression

Suggested Readings/ Books:

1. Jerry Banks, John S. Carson II, Barry L.Nelson and David M.Nicol, ”Discrete- event system and simulation”, Prentice Hall of India.
2. Averill M.Law, “Simulation modeling and analysis (SIE)”, Tata McGraw Hill India.
3. David Cloud, Larry Rainey, “Applied Modeling and Simulation”, Tata McGraw Hill.
4. Gabriel A. Wainer, “Discrete-event modeling and simulation: a practitioner’s approach”, CRC Press.
5. Bernard P. Zeiger, Herbert Praehofer, Tag Gon Kim, “Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems”, Academic Press.
6. Walter J. Karplus, George A. Bekey, Boris YakobKogan, “Modeling and simulation: theory and practice”, Springer.

CourseCode: BTCS 607-18	**CourseTitle:** Simulation and Modeling Lab	**L:0;T:0; P:**	**Credits**

Detailed List of Tasks:

1. Implementation of Basic Operations on Matrices.
2. Implementation of Chi-square goodness-of-fit test.
3. Practical implementation of Queuing Models.
4. Design Inventory System.
5. Implementation of Monte-Carlo Simulation method.
6. Analysis of Discrete and Continuous Distributions.
7. Generation of Random Numbers using Linear Congruential Method.
8. Generation of Random Numbers using Combined Linear Congruential Method.
9. Evaluation of system design using Regression Analysis.
10. Simulate a network using any network simulator.

SuggestedTools - Scilab, Tortuga and Extend. Introduction to network simulators - NS2, CloudSim, Wireshark.

Course Code: BTCS608-18	**Course Title:Internet of Things**	**L:3; T:0; P:0**	**3Credits**

DETAIL CONTENTS

1. Introduction to IoT

Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Everything as a Service(XaaS), Role of Cloud in IoT, Security aspects in IoT.

(8 Hours) , CO1

2. Elements of IoT

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- Programming API's (using Python /Node.js /Arduino) for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP

(9 Hours), CO2

3. IoT Application Development

Solution framework for IoT applications- Implementation of Device integration, Data acquisition and integration, Device data storage- Unstructured data storage on cloud/local server, Authentication, authorization of devices.

(18 Hours) CO3

4. IoT Case Studies

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

(10 Hours),CO4

Course Outcomes: After the completion of this course, the students will be able to:

CO1: Understand internet of Things and its hardware and software components

CO2:Interface I/O devices, sensors & communication modules

CO3:Remotely monitor data and control devices

CO4:Develop real life IoT based projects

List of suggested books :

1. Vijay Madisetti, Arshdeep Bahga, Ïnternet of Things, "A Hands on Approach", University Press

2. Dr. SRN Reddy, Rachit Thukral and Manasi Mishra, "Introduction to Internet of Things: A practical Approach", ETI Labs

3. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press

4. Jeeva Jose, "Internet of Things", Khanna Publishing House, Delhi

5. Adrian McEwen, "Designing the Internet of Things", Wiley

6. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill

7. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media

Course Code: BTCS609-18	**Course Title: Internet of Things Lab**	**L:0; T:0; P:2**	**1Credits**

LIST OF PRACTICALS

1. Familiarization with Arduino/Raspberry Pi and perform necessary software installation.

2. To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.

3. To interface Push button/Digital sensor (IR/LDR) with Arduino/Raspberry Pi and write a program to turn ON LED when push button is pressed or at sensor detection.

4. To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.

5. To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.

6. To interface OLED with Arduino/Raspberry Pi and write a program to print temperature and humidity readings on it.

7. To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.

8. To interface Bluetooth with Arduino/Raspberry Pi and write a program to turn LED ON/OFF when '1'/'0' is received from smartphone using Bluetooth.

9. Write a program on Arduino/Raspberry Pi to upload temperature and humidity data to thingspeak cloud.

10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thingspeak cloud.

11. To install MySQL database on Raspberry Pi and perform basic SQL queries.

12. Write a program on Arduino/Raspberry Pi to publish temperature data to MQTT broker.

Course Code:BTCS 610-18	**Course Title : Digital Image Processing**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: Introduction of Digital Image Processing (DIP)

Introduction to the DIP areas and applications; Components of Digital Image Processing; Elements of Visual Perception; Image Sensing and Acquisition; Image Sampling and Quantization; Relationships between pixels; color models.

[7**hrs] (CO 1)**

UNIT 2: Image Enhancement

Spatial Domain: Gray level transformations; Histogram processing; Basics of Spatial Filtering; Smoothing and Sharpening Spatial Filtering

Frequency Domain: Introduction to Fourier Transform; Smoothing and Sharpening frequency domain filters; Ideal, Butterworth and Gaussian filters

[10hrs] (CO 2)
UNIT 3: Image Restoration

Noise models; Mean Filters; Order Statistics; Adaptive filters; Band reject Filters; Band pass Filters; Notch Filters; Optimum Notch Filtering; Inverse Filtering; Wiener filtering

[8hrs] (CO 3)

UNIT4: Feature Extraction and Image Segmentation

Feature Extraction: Contour and shape dependent feature extraction, Extraction of textural features

Segmentation: Detection of Discontinuities; Edge Linking and Boundary detection; Region based segmentation; Morphological processing- erosion and dilation.

[10hrs] (CO 4)

UNIT 5: Image Compression and Encoding

Entropy-based schemes, Transform-based encoding, Predictive encoding and DPCM, Vector quantization, Huffman coding. **[10hrs](CO 5)**

Course Outcomes:

After undergoing this course, the students will be able to:
CO1: Understand the basic concepts of DIP.
CO2: Improve the quality of digital images.
CO3: Understand and De-noise Digital Images
CO4: Segment digital images and extract various features from digital images
CO5: Understand various image compression techniques and apply such techniques to compress digital images for reducing the sizes of digital images.

Suggested Readings/ Books:

1. Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
2. Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011.
3. Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
4. Nick Efford, "Digital Image Processing a practical introduction using Java", Third Edition, Pearson Education, 2004.
5. R.C. Gonzalez, R.E. Woods, and S. L. Eddins "Digital Image Processing using MATLAB", Pearson Prentice-Hall, 2004.
6. Sandipan Dey, "Hands-On Image Processing with Python", Packt, 2018

Course Code:BTCS 611-18	**Course Title: Digital Image Processing Lab**	**L:0;T:0; P:**	**Credits**

Detailed List of Tasks:

1. WAP to draw Histogram of digital Image
2. WAP to enhance the quality of digital image using various gray level transformations.
3. WAP to enhance the quality of digital image using Average and median filters in spatial domain.
4. WAP to convert digital image from spatial domain to frequency domain.
5. Implement low pass filters in frequency domain for image enhancement.
6. Implement high pass filters in frequency domain for image enhancement.
7. Implement Optimum Notch Filtering for de-noising of digital image.
8. WAP to segment digital image using thresholding approach.
9. WAP to extract shape and texture based features from image.
10. WAP to compress digital image using entropy based approach.

Suggested Tools – MATLAB/Python/JAVA

Course Code: BTCS 612-18	Course Title: Cloud Computing	3L:0T:0P	3Credits

Detailed Contents:

UNIT1: **Introduction** : Definition of cloud, characteristics of cloud, historical developments & challenges ahead, the vision of cloud computing, Driving factors towards cloud, Comparing grid with utility computing, cloud computing and other computing systems, types of workload patterns for the cloud, IT as a service, Applications of cloud computing.
[8hrs] (CO1)

UNIT2: Cloud computing concepts: Introduction to virtualization techniques, Characteristics of virtualization, Pros and Cons of virtualization Technology, Hypervisors, Types of hypervisors, Multitenancy, Application programming interfaces (API), Elasticity and scalability. **[9hrs] (CO2)**

UNIT 3: Cloud service models: Cloud service models, Infrastructure as a service (IaaS) architecture- details and example, Platform as a service (PaaS) architecture- details and example, Software as a service (SaaS) architecture-- details and example, Comparison of cloud service delivery models. **[6hrs] (CO3)**

UNIT 4: Cloud deployment models: Introduction to cloud deployment models, Public clouds, Private clouds, Hybrid clouds, Community clouds, Migration paths for cloud, Selection criteria for cloud deployment. **[6hrs] (CO4)**

UNIT 5: Security in cloud computing: Understanding security risks, Principal security dangers to cloud computing, Internal security breaches, User account and service hijacking, measures to reduce cloud security breaches
Case Studies: Comparison of existing Cloud platforms /Web Services.
[6hrs] (CO5)

Course Outcomes:

After undergoing this course, the students will be able to:
CO1: Understand the core concepts of the cloud computing paradigm
CO2: Understanding importance of virtualization along with their technologies
CO3: Analyze various cloud computing service and deployment models and apply them to solve problems on the cloud.
CO4: Implementation of various security strategies for different cloud platform

Suggested Readings/ Books:

1. Raj Kumar Buyya, James Broberg, Andrezei M.Goscinski, "Cloud Computing: Principles and Paradigms",Wiley 2011
2. Anthony T. Velte, Toby J. Velte and Robert Elsenpeter, "Cloud Computing: A practical Approach", McGraw Hill, 2010.
3. Barrie Sosinsky, "Cloud Computing Bible", Wiley, 2011.
4. Judith Hurwitz, Robin Bllor, Marcia Kaufman, Fern Halper, "Cloud Computing for dummies", 2009.

Reference Books

1. Rajkumar Buyya, Christian Vecchiola, S.Thamarai Selvi, "Mastering Cloud Computing"

TMH 2013.

2. George Reese “Cloud Application Architectures”, First Edition, O‟Reilly Media 2009.
3. Dr. Kumar Saurabh “Cloud Computing” 2nd Edition, Wiley India 2012.

Course Code: BTCS 612-18	**Course Title: Cloud Computing Lab**	**L:0;T:0; P:2**	**1 Credits**

Detailed List of Tasks:

11. Install VirtualBox/VMware Workstation on different OS.
12. Install different operating systems in VMware.
13. Simulate a cloud scenario using simulator.
14. Implement scheduling algorithms.
15. To study cloud security management.
16. To study and implementation of identity management
17. Case Study - Amazon Web Services/Microsoft Azure/Google cloud services.

Suggested Tools –Matlab, Cloudsim

ELECTIVE III

Course Code: BTCS 614-18	Course Title: Software Project Management	3L:0T:0P	3 Credits

Detailed Contents:

MODULE 1: Introduction

Project Evaluation and Planning - Activities in Software Project Management, Overview of Project Planning, Stepwise planning, contract management, Software processes and process models.

[5hrs] (CO1)

MODULE 2: Cost Benefit Analysis

Cost Benefit Analysis, Cash Flow Forecasting, Cost-Benefit Evaluation Techniques, Risk Evaluation. Project costing, COCOMO 2, Staffing pattern, Effect of schedule compression, Putnam's equation, Capers Jones estimating rules of thumb.

[6hrs] (CO2)

MODULE 3: Project Scheduling

Project Sequencing and Scheduling Activities, Scheduling resources, Critical path analysis, Network Planning, Risk Management, Nature and Types of Risks, Managing Risks, Hazard Identification, Hazard Analysis, Risk Planning and Control, PERT and Monte Carlo Simulation techniques.

[8hrs] (CO3)

MODULE 4: Monitoring & Control

Monitoring and Control- Collecting Data, Visualizing Progress, Cost Monitoring, review techniques, project termination review, Earned Value analysis, Change Control, Software Configuration Management (SCM), Managing Contracts, Types of Contracts, Stages in Contract Placement, Typical Terms of a Contract, Contract Management and Acceptance.

[8hrs] (CO4)

MODULE 5: Quality Management

Quality Management and People Management- Introduction, Understanding Behavior, Organizational Behavior, Selecting the Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, Working in Groups, Organization and team structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. ISO and CMMI models, Testing, and Software reliability, test automation, Overview of project management tools.

[9hrs] (CO5)

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Course Outcomes:

After undergoing this course, the students will be able to:

- CO1: Explain project management in terms of the software development process
- CO2: Estimate project cost and perform cost-benefit evaluation among projects
- CO3: Apply the concepts of project scheduling and risk management.
- CO4: Explain Software configuration management and the concepts of contract management.
- CO5: Apply quality models in software projects for maintaining software quality and reliability

Suggested Readings/Books:

1. Bob Hughes, Mike Cotterell, "Software Project Management", Tata McGraw Hill. (2009)

2. Royce, "Software Project Management", Pearson Education. (2005).

3. Robert K. Wysocki, "Effective Software Project Management", Wiley.(2006)

4. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.

5. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.

6. Kassem, Software Engineering, Cengage Learning

Course Code: BTCS 615-18	**Course Title: Software Project Management Lab**	**L:0;T:0; P:2**	**1 Credits**

Detailed List of Tasks:

Task 1: Introduction to MS Project

Task 2: Create a Project Plan

- Specify project name and start (or finish) date.
- Identify and define project tasks.
- Define duration for each project task.
- Define milestones in the plan
- Define dependency between tasks

Task 3: Create Project Plan contd.

- Define project calendar.
- Define project resources.

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- Specify resource type and resource rates
- Assign resources against each task
- Baseline the project plan

Task 4: Execute and Monitor the Project Plan

- Update % Complete with current task status.
- Review the status of each task.
- Compare Planned vs Actual Status
- Review the status of Critical Path
- Review resources assignation status

Task 5: Generate Dashboard and Reports

- Dashboard
- Resource Reports
- Cost Reports
- Progress Reports

Suggested Tools – MS Project, Rational Team Concert

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Plan and manage projects.

CO2: Consolidate and communicate information about their project.

CO3: Create Gantt charts and PERT (Project Evaluation Review Technique) chart of their project

CO4: Manage resources, assignments, work allocation and generate reports to assess project status, project cost status and resource utilization.

CO5: Identify factors affecting the critical path of their project.

Course Code: BTCS 618-18	**Course Title : Machine Learning**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: **Introduction:** Well-Posed learning problems, Basic concepts, Designing a learning system, Issues in machine learning. Types of machine learning: Learning associations, Supervised learning, Unsupervised learning and Reinforcement learning.

[4hrs] (CO 1)

UNIT 2: Data Pre-processing: Need of Data Pre-processing, Data Pre-processing Methods: Data Cleaning, Data Integration, Data Transformation, Data Reduction; Feature Scaling (Normalization and Standardization), Splitting dataset into Training and Testing set.

[4hrs] (CO 2)

UNIT 3: Regression: Need and Applications of Regression, Simple Linear Regression, Multiple Linear Regression and Polynomial Regression, Evaluating Regression Models

Performance (RMSE, Mean Absolute Error, Correlation, RSquare, Accuracy with acceptable error, scatter plot, *etc*.)

[6hrs] (CO 3)

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UNIT 4 Classification: Need and Applications of Classification, Logistic Regression, Decision tree, Tree induction algorithm – split algorithm based on information theory, split algorithm based on Gini index; Random forest classification, Naïve Bayes algorithm; K-Nearest Neighbours (K-NN), Support Vector Machine (SVM), Evaluating Classification Models Performance (Sensitivity, Specificity, Precision, Recall, *etc*.). **Clustering**: Need and Applications of Clustering, Partitioned methods, Hierarchical methods, Density-based methods. **[12hrs] (CO 4)**

UNIT 5 Association Rules Learning: Need and Application of Association Rules Learning, Basic concepts of Association Rule Mining, Naïve algorithm, Apriori algorithm. **Artificial Neural Network:** Need and Application of Artificial Neural Network, Neural network representation and working, Activation Functions. **Genetic Algorithms:** Basic concepts, Gene Representation and Fitness Function, Selection, Recombination, Mutation and Elitism.
[14hrs] (CO 5)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Analyse methods and theories in the field of machine learning

CO2: Analyse and extract features of complex datasets

CO3: Deploy techniques to comment for the Regression

CO4: Comprehend and apply different classification and clustering techniques

CO5: Understand the concept of Neural Networks and Genetic Algorithm

Suggested Readings/ Books:

Text Books:

1. Mitchell M., T., Machine Learning, McGraw Hill (1997) 1stEdition.
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rdEdition.
3. Vijayvargia Abhishek, Machine Learning with Python, BPB Publication (2018)

Reference Books:

1. Bishop M., C., Pattern Recognition and Machine Learning, Springer-Verlag (2011) 2ndEdition.
2. Michie D., Spiegelhalter J. D., Taylor C. C., Campbell, J., Machine Learning, Neural and Statistical Classification. Overseas Press (1994).

Course Code: BTCS619-18	**Course Title: machine Learning Lab**	**L:0;T:0;2 P:**	**1Credits**

Detailed List of Tasks:

1. Implement data pre-processing

2. Deploy Simple Linear Regression
3. Simulate Multiple Linear Regression
4. Implement Decision Tree

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5. Deploy Random forest classification
6. Simulate Naïve Bayes algorithm
7. Implement K-Nearest Neighbors (K-NN), k-Means
8. Deploy Support Vector Machine, Apriori algorithm
9. Simulate Artificial Neural Network
10. Implement the Genetic Algorithm code

Suggested Tools Python/R/MATLAB

Course Code: BTCS620-18	**Course Title:Mobile Application Development**	**L:3; T:0; P:0**	**3Credits**

Details of course:

Unit-1

Introduction to Android: The Android Developing environment, Android SDK, Introduction to Open Handset Alliance, Development Framework, Application Fundamentals; Device Compatibility, System permissions, Understanding Anatomy of Android Application, Android Development Tools **6 hrs. ,CO 1**

Unit-II

Getting started with Mobility: Mobility Landscape, Mobile Platforms, Mobile apps development, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Setting up the mobile apps development environment with emulator **6 hrs., CO1**

Unit-III

Building block of Mobile apps: App user Interface Designing, Layout, User Interface elements, VUIs and Mobile Apps, Text to Speech Techniques, Designing the Right UI, Activity states and lifecycle, Interaction among activities **6 hrs., CO 2**

Unit-IV

Sprucing up Mobile apps: App functionality beyond user interface- Threads, sync task, Services-states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs Native data handling: on device file I/O, shared preferences, mobile databases such as SQLite, Working with a content provider **8 hrs., CO 3,4**

Unit-V

Factors in Developing Mobile Applications: Mobile Software Engineering, Frameworks and Tools, Generic UI Development, Android User

Graphics and Multimedia: Performance and Multithreading, Graphics and UI Performance, Android Graphics, Mobile Agents and Peer-to-Peer Architecture, Android Multimedia

8 hrs., CO 4,5

Unit-VI

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Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Testing, Security and Hacking, Active Transactions, More on Security

8hrs., CO 5

Course Outcomes:

CO 1: Describe those aspects of mobile programming that make it unique from programming for other platforms,
CO 2: Critique mobile applications on their design pros and cons,
CO 3: Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces,
CO 4: Program mobile applications for the Android operating system that use basic and advanced phone features, and
CO 5: Deploy applications to the Android marketplace for distribution

References:

1. Rick Rogers, John Lombardo, Meike Blake, "Android application development", Ist Edition, O'Reilly, 2010

2. Lauren Darcey and Shane Conder,"Android Wireless Application Development", 2nd ed. Pearson Education, 2011

3. Wei-Meng Lee , Beginning Android 4 development ,2012 by John Wiley & Sons

4. Jeff Mewherter, Scott Gowell,Wrox Publisher,"Professional Mobile Application Development", Ist Edition, 2012

5. Reto Meier, "Professional Android 4 Application Development", Wrox, 2012

Course Code: BTCS621-18	**Course Title:Mobile Application Development Lab**	**L:0; T:0; P:2**	**1Credits**

LIST OF PRACTICALS

1. Introduction to Android platform. Introduction to the tools used in the lab. Create a simple application

2. Understand the app idea and design user interface/wireframes of mobile app

3. Set up mobile app development environment

4. Write a program using activity class to show different events.

5. Write a program to convert text to speech.

6. Develop and debug mobile app components – User interface, services, notifications,

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broadcast receivers, data components

7. Using emulator to deploy and run mobile apps

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8. Testing mobile app- unit testing, black box testing and test automation

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SEVENTH / EIGHTTH SEMESTER

Course Code: BTCS 701-18	**Course Title : Network Security and Cryptography**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: Introduction (3 Hours)

Introduction to Cryptography, Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, CIA model

[5hrs] (CO 1)

UNIT 2: Math Background

Modular Arithmetic, Euclidean and Extended Euclidean algorithm, Prime numbers, Fermat and Euler's Theorem **[5hrs] (CO 1)**

UNIT 3: Cryptography

Dimensions of Cryptography, Classical Cryptographic Techniques Block Ciphers (DES, AES) : Feistal Cipher Structure, Simplifies DES, DES, Double and Triple DES, Block Cipher design Principles, AES, Modes of Operations Public-Key Cryptography : Principles Of Public-Key Cryptography, RSA Algorithm, Key Management, Diffie-Hellman Key Exchange, Elgamal Algorithm, Elliptic Curve Cryptography

[12hrs] (CO 2)

UNIT 4 Hash and MAC Algorithms

Authentication Requirement, Functions, Message Authentication Code, Hash Functions, Security Of Hash Functions And Macs, MD5 Message Digest Algorithm, Secure Hash Algorithm, Digital Signatures, Key Management : Key Distribution Techniques, Kerberos

[6hrs] (CO 3)

UNIT 5 Security in Networks

Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP, S/MIME

[7hrs] (CO 4)

Course Outcomes:

After undergoing this course, the students will be able to:

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CO1: Understand the fundamental principles of access control models and techniques, authentication and secure system design

CO2: Have a strong understanding of different cryptographic protocols and techniques and be able to use them.

CO3: Apply methods for authentication, access control, intrusion detection and prevention.

CO4: Identify and mitigate software security vulnerabilities in existing systems.

Suggested Readings/ Books:

1. Cryptography And Network Security Principles And Practice Fourth Edition, William Stallings, Pearson Education

2. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR

3. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall

4. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

Course Code: BTCS -702-18	Course Title: Data Warehousing and Data Mining	3L: 0T: 0P	Credits: 3

Detailed Contents:

UNIT 1:

Data Warehousing Introduction: design guidelines for data warehouse implementation, Multidimensional Models; OLAP- introduction, Characteristics, Architecture, Multidimensional view Efficient processing of OLAP Queries, OLAP server Architecture ROLAP versus MOLAP Versus HOLAP and data cube, Data cube operations, data cube computation.

Data mining: What is data mining, Challenges, Data Mining Tasks, Data: Types of Data, Data Quality, Data Pre-processing, Measures of Similarity and Dissimilarity

[10hrs]

UNIT 2:

Data mining: Introduction, association rules mining, Naive algorithm, Apriori algorithm, direct hashing and pruning (DHP), Dynamic Item set counting (DIC), Mining frequent pattern without candidate generation (FP, growth), performance evaluation of algorithms

Classification: Introduction, decision tree, tree induction algorithms – split algorithm based on information theory, split algorithm based on Gini index; naïve Bayes method; estimating predictive accuracy of classification method

[10 hrs]

UNIT 3:

Cluster analysis: Introduction, partition methods, hierarchical methods, density based methods, dealing with large databases, cluster software

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Search engines: Characteristics of Search engines, Search Engine Functionality, Search Engine Architecture, Ranking of web pages, The search engine history, Enterprise Search, Enterprise Search Engine Software.

[10 hrs]

UNIT 4:

Web data mining: Web Terminology and Characteristics, Locality and Hierarchy in the web, Web Content Mining, Web Usage Mining, Web Structure Mining, Web mining Software.**[8 hrs]**

Suggested Readings / Books:

1. Carlo Vercellis, Business Intelligence: Data mining and Optimization for Decision Making, WILEY.
2. Han J., Kamber M. and Pei J. , b Data mining concepts and techniques, Morgan Kaufmann Publishers (2011) 3rd ed.
3. Pudi V., Krishana P.R., Data Mining, Oxford University press, (2009) 1st ed.
4. Adriaans P., Zantinge D., Data mining, Pearsoneducation press (1996), 1st ed.
5. Pooniah P. , Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

ELECTIVE IV

Course Code: BTCS 704-18	**Course Title : Deep Learning**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: **Machine Learning Basics:** Learning, Under-fitting, Overfitting, Estimators, Bias, Variance, Maximum Likelihood Estimation, Bayesian Statistics, Supervised Learning, Unsupervised Learning and Stochastic Gradient Decent.
[4hrs] (CO 1)

UNIT 2: Deep Feedforward Network: Feed-forward Networks, Gradient-based Learning, Hidden Units, Architecture Design, Computational Graphs, Back-Propagation, Regularization, Parameter Penalties, Data Augmentation, Multi-task Learning, Bagging, Dropout and Adversarial Training and Optimization.

[4hrs] (CO 2)

UNIT 3: Convolution Networks: Convolution Operation, Pooling, Basic Convolution Function, Convolution Algorithm, Unsupervised Features and Neuroscientific for convolution Network. **[6hrs] (CO 3)**

UNIT 4: Sequence Modelling: Recurrent Neural Networks (RNNs), Bidirectional RNNs, Encoder- Decoder Sequence-to-Sequence Architectures, Deep Recurrent Network, Recursive Neural Networks and Echo State networks.
[12hrs] (CO 4)

UNIT 5: Deep Generative Models: Boltzmann Machines, Restricted Boltzmann Machines, Deep Belief Networks, Deep Boltzmann Machines, Sigmoid Belief Networks, Directed Generative Net, Drawing Samples from Auto –encoders.
[14hrs] (CO 5)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Comprehend the advancements in learning techniques

CO2: Compare and explain various deep learning architectures and algorithms.

CO3: Demonstrate the applications of Convolution Networks

CO4: Apply Recurrent Network for Sequence Modelling

CO5: Deploy the Deep Generative Models

Suggested Readings/ Books:

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Text Books:

1. Goodfellow L., Bengio Y. and Courville A., Deep Learning, MIT Press (2016).
2. Patterson J. and Gibson A., Deep Learning: A Practitioner's Approach, O'Reilly (2017), 1st ed.

Reference Books:

1. Haykin S., Neural Network and Machine Learning, Prentice Hall Pearson (2009), 3rd ed.
2. Geron A., Hands-on Machine Learning with Sci-kit and TensorFlow, O'Reilly Media (2017)

Course Code: BTCS 705-18	**Course Title: Deep Learning** Lab	**L:0;T:0; 2P:**	**Credits;1**

Detailed List of Tasks:

- Creating a basic network and analyze its performance
- Deploy the Confusion matrix and simulate for Overfitting
- Visualizing a neural network
- Demo: Object Detection with pre-trained RetinaNet with Keras
- Neural Recommender Systems with Explicit Feedback
- Backpropagation in Neural Networks using Numpy
- Neural Recommender Systems with Implicit Feedback and the Triplet Loss
- Fully Convolutional Neural Networks
- ConvNets for Classification and Localization
- Text Classification and Word Vectors
- Character Level Language Model (GPU required)

Suggested Tools Python/R/MATLAB

Course Code: BTCS706-18	**Course Title:** Distributed Databases	**3L: 0T: 0P**	**Credits: 3**

Detailed Contents:

Unit 1:

INTRODUCTION: Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts

DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE: Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.

6 hrs., CO1

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Unit 2:

DISTRIBUTED DATABASE DESIGN: Alternative design strategies; Distributed design issues; Fragmentation; Data allocation.

SEMANTICS DATA CONTROL: View management; Data security; Semantic Integrity Control.

QUERY PROCESSING ISSUES: Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data. **10 hrs., CO1**

Unit 3:

DISTRIBUTED QUERY OPTIMIZATION: Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.

TRANSACTION MANAGEMENT: The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.

CONCURRENCY CONTROL: Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management. **10 hrs., CO2**

Unit 4:

RELIABILITY:Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.

PARALLEL DATABASE SYSTEMS : Parallel architectures; parallel query processing and optimization; load balancing.

ADVANCED TOPICS: Databases, Distributed Object Management, Multi-databases. **10 hrs., CO2,3**

<u>COURSE OUTCOMES</u>

After completion of course, students would be able to:

CO1: Design trends in distributed systems.

CO2: Apply network virtualization in distributed environment.

CO3: Apply remote method invocation and objects.

<u>References:</u>

1. Principles of Distributed Database Systems, M.T. Ozsu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

Course Code: BTCS707-18	**Course Title:** Distributed Databases lab	**L: T: 2P**	**Credits: 1**

Detailed list of Tasks:

Programs may be implemented using any open source tool

Expt. 1: Installation and configuration of database packages.

Expt. 2: Creating and managing database objects (Tables, views, indexes etc.)

Expt. 3: Creating and managing database security through user management.

Expt. 4: Creating and maintaining database links.

Expt. 5: Implement Partitioning on the database tables.

Expt. 6: Implement various Transaction concurrency control methods [i.e. lock's] by executing multiple update and queries.

Expt. 7: Performance tuning of SQL queries.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

Course Code: BTCS708-18	**Course Title:** Computer Vision	**3L: 0T: 0P**	**Credits: 3**

Detailed Contents:

Unit 1: Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis. **6 hrs., CO1**

Unit 2:

Edge detection, Edge detection performance, Hough transform, corner detection. **4 hrs., CO1**

Unit 3:

Segmentation, Morphological filtering, Fourier transform. **4 hrs., CO1**

Unit 4:

Feature extraction, shape, histogram, color, spectral, texture, using CVIP tools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing. **8 hrs., CO2**

Unit 5:

Pattern Analysis: Clustering: K-Means, K-Medoids, Mixture of Gaussians Classification: Discriminant Function, Supervised, Un-supervised, Semi- supervised. Classifiers: Bayes, KNN, ANN models;

Dimensionality Reduction: PCA, LDA, ICA, and Non- parametric methods.

Recent trends in Activity Recognition, computational photography, Biometrics **8 hrs., CO1**

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COURSE OUTCOMES

After completion of course, students would be able to:

CO1: Understand image detection and analysis

CO2: Identify features to recognize object , scene and categorization from images.

CO3: Develop the skills necessary to build computer vision applications.

References:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary of Computer Vision and ImageProcessing, by Fisheretal.

Course Code: BTCS708-18	**Course Title:** Computer Vision lab	**L: T: 2P**	**Credits: 1**

Detailed list of Tasks:

Programs may be implemented using MATLAB/C/C++/Java/Python on binary/grayscale/color images.

Expt. 1: Implementation of basic image transformations:

a. Log
b. Power law
c. Negation

Expt. 2: Implementation the following:

a. Histogram processing
b. Histogram equalization/matching

Expt. 3: Implementation of piecewise linear transformations

a. Contrast stretching
b. Grey level slicing
c. Bit plane slicing

Expt. 4: Implementation of image enhancement/smoothing using

a. Linear (weighted and non-weighted filters)
b. Order statistics filters (Nonlinear filters)
   i. Mean
   ii. Median
   iii. Min
   iv. Max
   v. Average

Expt. 5: Implementation of image enhancement/sharpening using

a. Laplacian operators
b. Sobel's operators
c. Robert's cross operators

Expt. 6: Implement the 2D-DFT to obtain Fourier coefficients and reconstruct the image, i.e., IDFT.

Expt. 7: Implement image enhancement using Fourier low pass filters

a. Ideal
b. Butterworth
c. Gaussian

Expt. 8: Implement image enhancement using Fourier high pass filters

a. Ideal

b. Butterworth

c. Gaussian

Expt. 9: Implement algorithms to detect the following in an image

a. Point

b. Line

c. Boundary

Expt. 10: Implement Hough transform to detect a line.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The team will have to demonstrate as well as have to give a presentation of the same.

Course Code: BTCS 710-18	Course Title : Agile Software Development	3L:0T:0P	3Credits

Detailed Contents:

UNIT 1: **Introduction**

Need of Agile software development, History of Agile, Agile context– manifesto, principles, methods, values. The benefits of agile in software development.

[6hrs] (CO 1)

UNIT 2: Agile Design Methodologies

Fundamentals, Design principles–Single responsibility, Open-closed, Liskov-substitution, Dependency-inversion, Interface-segregation.

[6hrs] (CO 2)

UNIT 3: Scrum

Introduction to scrum framework, Roles: Product owner, team members and scrum master, Events: Sprint, sprint planning, daily scrum, sprint review, and sprint retrospective, Artifacts: Product backlog, sprint backlog and increments. User stories- characteristics and contents.

[8hrs] (CO 3)

UNIT 4: Kanban

Introduction to Kanban framework, Workflow, Limit the amount of work in progress, pulling work from column to column, Kanban board, Adding policies to the board, Cards and their optimization. **[6hrs]** (**CO 4)**

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UNIT 5: Extreme Programming

Basic values and principles, Roles, Twelve practices of XP, Pair programming, XP team, Life cycle and tools for XP.

[6hrs] (CO 5)

UNIT 6: Agile Testing

The Agile lifecycle and its impact on testing, Test driven development– Acceptance tests and verifying stories, writing a user acceptance test, Developing effective test suites, Continuous integration, Code refactoring. Risk based testing, Regression tests, Test automation. **[6hrs] (CO 6)**

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: Understand concept of agile software engineering and its advantages in software development.

CO2 Explain the role of design principles in agile software design.

CO3 Define the core practices behind Scrum framework.

CO4 Understand key principles of agile software development methodology-Kanban.

CO5 Describe implications of functional testing, unit testing, and continuous integration.

CO6 Understand the various tools available to agile teams to test the project.

Suggested Readings/ Books:

1. Ken Schawber, Mike Beedle, “Agile Software Development with Scrum”, Pearson.
2. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall.
3. Mike Cohn, “User Stories Applied: For Agile Software Development”, Addison Wesley Signature Series.
4. Lisa Crispin, Janet Gregory, “Agile Testing: A Practical Guide for Testers and Agile Teams”, Addison Wesley.
5. Paul VII, “Agile: The Complete Overview of Agile Principles and Practices (Agile Product Management)”.
6. Robert Martin, “Agile Software Development, Principles, Patterns, and Practices”, Pearson New International Edition.
7. Greene Jennifer,” Learning Agile”, O’Reilly Series.

Course Code: BTCS 711-18	Course Title : Agile Software Development Lab	L:0T:2P	Credits:1

Detailed List of Tasks:

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1. Understand the background and driving forces for taking an Agile Approach to Software Development.
2. Build out a backlog and user stories.
3. To study and use automated build tool.
4. To study-- version control tool.
5. To study Continuous Integration tool.
6. Apply Design principle and Refactoring to achieve agility.
7. Perform Testing activities within an agile project.
8. Mini Project: based on tools

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Course Code: BTCS721-18	Course Title: Block Chain Technology	3L:0 T: 0P	Credits: 3

Detailed Contents:

INTRODUCTION TO BLOCKCHAIN

Blockchain- Public Ledgers, Blockchain as Public Ledgers -Bitcoin, Blockchain 2.0, Smart Contracts, Block in a Blockchain, Transactions-Distributed Consensus, The Chain and the Longest Chain - Cryptocurrency to Blockchain 2.0 - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree

BITCOIN AND CRYPTOCURRENCY

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursor for Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay, Consensus introduction, Distributed consensus in open environments-Consensus in a Bitcoin network

BITCOIN CONSENSUS

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases, Design issues for Permissioned Blockchains, Execute contracts- Consensus models for permissioned blockchain-Distributed consensus in closed environment Paxos

DISTRIBUTED CONSENSUS

RAFT Consensus-Byzantine general problem, Byzantine fault tolerant system-Agreement Protocol, Lamport-Shostak-Pease BFT Algorithm-BFT over Asynchronous systems, Practical Byzantine Fault Tolerance

HYPER LEDGER FABRIC & ETHERUM

Architecture of Hyperledger fabric v1.1-Introduction to hyperledger fabric v1.1, chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity, Smart contracts, Truffle Design and issue Crypto currency, Mining, DApps, DAO

BLOCKCHAIN APPLICATIONS

Internet of Things-Medical Record Management System-Block chain in Government and Block chain Security-Block chain Use Cases –Finance

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COURSE OUTCOMES

CO1: Understand emerging abstract models for Block chain Technology.

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CO2: Identify major research challenges and technical gaps existing between theory and practice in crypto currency domain.

CO3: It provides conceptual understanding of the function of Blockchain as a method of securing distributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.

CO4: Apply hyperledger Fabric and Etherum platform to implement the Block chain Application.

REFERENCES

1. Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks by Bashir, Imran,2017.

2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder. Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton University Press, 2016.

3. Joseph Bonneau et al, SoK: Research perspectives and challenges for Bitcoin and cryptocurrency, IEEE Symposium on security and Privacy, 2015.

Course Code: 713-18	**Course Title:** Block chain Technology lab	**L: T: 2P**	**Credits:1**

1. To Develop Naive Block chain construction.
2. Design Memory Hard algorithm and its Implementation
3. Design Toy application using Blockchain
5. Program to Solve a Mining puzzles using Block chain
6. The ability to formulate mathematical models and problem-solving skills through programming techniques for addressing real-time problems using appropriate data structures and algorithms.
7. The ability to provide design, build, and deploy a distributed application and provide solutions using block chain applications to enhance business measures by sharing information safely and effectively.
8. The ability to create crypto currencies and give a strong technical understanding of Block chain technologies with an in-depth understanding of applications, open research challenges, and future directions.

Course Code: BTCS714-18	**Course Title:** Parallel Computing	**3L: 0T: 0P**	**Credits: 3**

Detailed Contents:

Introduction: Paradigms of parallel computing: Synchronous - vector/array, SIMD, Systolic; Asynchronous - MIMD, reduction paradigm.

Hardware taxonomy: Flynn's classifications, Handler's classifications. Software taxonomy: Kung's taxonomy, SPMD.

Abstract parallel computational models: Combinational circuits, Sorting network, PRAM models, Interconnection RAMs. Parallelism approaches - data parallelism, control parallelism

Performance Metrices: Laws governing performance measurements. Metrices - speedups, efficiency, utilization, communication overheads, single/multiple program performances, bench marks.

Parallel Processors: Taxonomy and topology - shared memory mutliprocessors, distributed memory networks. Processor organization - Static and dynamic interconnections. Embeddings and simulations.

Parallel Programming: Shared memory programming, distributed memory programming, object oriented programming, data parallel programming, functional and dataflow programming.

Scheduling and Parallelization: Scheduling parallel programs. Loop scheduling. Parallelization of sequential programs. Parallel programming support environments.

Books and References:

1. M. J. Quinn. Parallel Computing: Theory and Practice , McGraw Hill, New York, 1994.
2. T. G. Lewis and H. El-Rewini. Introduction to Parallel Computing , Prentice Hall, New Jersey, 1992.
3. T. G. Lewis. Parallel Programming: A Machine-Independent Approach , IEEE Computer Society Press, Los Alamitos, 1994.
   Research articles.

Course Code: BTCS715-18	**Course Title:** Parallel Computing lab	**L: T: 2P**	**Credits:** 1

The details may be designed by course instructor as per the theory.

BTCS 716-18	**Adhoc and Wireless Sensor Networks**	**L:03, T:0, P: 0**	**Credits: 3**

Detailed Contents:

UNIT 1:
{07hrs}(CO1)

ADHOC AND SENSORS NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS:

Wireless Sensor Networks (WSNs): concepts and architectures - Applications of Ad Hoc and Sensor Networks - Design Challenges in Ad hoc and Sensor Networks. Wireless Networks, Issues in Ad hoc wireless networks, Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT2:
{09hrs}(CO2)

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WSN NETWORKING CONCEPT AND MAC PROTOCOLS :

Issues in Designing a MAC Protocol for Ad Hoc Wireless Networks - Design Goals of a MAC Protocol for Ad Hoc Wireless Networks, MAC Protocols for wireless sensors Networks, Low duty cycle Protocols and Wakeup concepts, Classification of MAC Protocols , S-MAC, Contention based protocols -PAMAS schedule based protocols –LEACH, IEEE 802.15.4. MAC protocols , Energy efficient routing challenges and issues in transport layer

UNIT 3:
{06hrs}(CO3)

ROUTING PROTOCOLS AND TRANSPORT LAYER IN AD HOC WIRELESS NETWORKS:

Routing Protocol: Issues in designing a routing protocol for Ad hoc networks - Classification- proactive routing - reactive routing (on-demand) - hybrid routing - Transport Layer protocol for Ad hoc networks - Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks -Classification of Transport Layer solutions-TCP over Ad hoc wireless ,

UNIT4:
{06hrs}(CO4)

SENSOR NETWORKS INTRODUCTION AND ARCHITECTURES:

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture – Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture – Sensor Network Scenarios, Transceiver Design Considerations.

UNIT 5:
{07hrs}(CO5)

SENSOR NETWORK SECURITY- NETWORK SECURITY :

Security in Ad Hoc Wireless Networks - Network Security Requirements. Network Security requirements issues and Challenges in security provisioning Network, Security Attacks. Layer wise attack in wireless sensor networks, possible solutions for Jamming, tampering black hole attack, Flooding attack, Key distribution and Management, Secure Routing -SPINS reliability requirements in sensors Networks. Sensor Network Platforms and Tools

Course Outcomes:

After undergoing this course, the students will be able to:

CO Nos.	Course Outcomes:
CO1	Explain the Fundamental Concepts and applications of ad hoc and wireless sensor networks and apply this knowledge to identify the suitable routing algorithm based on the network.
CO2	Apply the knowledge to identify appropriate physical and MAC layer protocols
CO3:	Understand the transport layer and Describe routing protocols for ad hoc wireless networks with respect to TCP design issues

CO 4	Be familiar with the OS used in Wireless Sensor Networks and build basic modules CO 5:

CO 5	Understand the Challenges in security provisioning ,Security Attacks and security issues possible in Adhoc and Sensors Networks

Suggested Readings/ Books:

Text Books:

1. C. Siva Ram Murthy, and B. S. Manoj, "Ad Hoc Wireless Networks: Architectures and Protocols ", Pearson Education, 2008.
2. Labiod. H, “Wireless Adhoc and Sensor Networks”, Wiley, 2008.
3. 3. Li, X, “Wireless ad -hoc and sensor Networks: theory and applications”, Cambridge University Press, 2008.

Reference Books

1. Carlos De Morais Cordeiro, Dharma Prakash Agrawal “Ad Hoc & Sensor Networks: Theory and Applications”, world Scientific Publishing Company, 2nd edition, 2011.
2. Feng Zhao and Leonides Guibas, "Wireless Sensor Networks", Elsevier Publication
3. Holger Karl and Andreas Willig “Protocols and Architectures for Wireless Sensor Networks”, Wiley, 2005 (soft copy available) .
4. Kazem Sohraby, Daniel Minoli, & Taieb Znati, “Wireless Sensor Networks Technology, Protocols, and Applications”, John Wiley, 2007. (soft copyavailable).
5. Anna Hac, “Wireless Sensor Network Designs”, John Wiley, 2003.(soft copy available)

Online Resources:

1. www.wirelessnetworksonline.com
2. www.securityinwireless.com
3. www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf Practice Aspects 1. NS2 Simulator tool

BTCS 717-18	**Adhoc and Wireless Sensor Networks Lab**	**L:0, T:0, P: 2**	**Credits: 1**

List of Experiments :

Sr. No	Name and list of Practical
1	Introduction of Wireless sensor network applications and its simulation
2	Network Simulator installation of wireless sensor network.
3	Implementation of routing protocol in NS2 for DSR protocol
4	Study other wireless sensor network simulators (Mannasim. Contiki
5	Implementation of routing protocol in NS2 for AODV protocol for TORA protocol

Course Code: BTCS718-18	Course Title: Quantum Computing	3L: 0T: 0P	Credits: 3

Detailed Syllabus

UNIT-1 Fundamental Concepts: Global Perspectives, Quantum Bits, Quantum Computation, Quantum Algorithms, Quantum Information, Postulates of Quantum Mechanisms. 8 Hrs.

UNIT-II Quantum Computation: Quantum Circuits – Quantum algorithms, Single Orbit operations, Control Operations, Measurement, Universal Quantum Gates, Simulation of Quantum Systems, Quantum Fourier transform, Phase estimation, Applications, Quantum search algorithms – Quantum counting – Speeding up the solution of NP – complete problems – Quantum Search for an unstructured database. 8 Hrs.

UNIT-III Quantum Computers: Guiding Principles, Conditions for Quantum Computation, Harmonic Oscillator Quantum Computer, Optical Photon Quantum Computer – Optical cavity Quantum electrodynamics, Ion traps, Nuclear Magnetic resonance. 8 Hrs.

UNIT-IV Quantum Information: Quantum noise and Quantum Operations – Classical Noise and Markov Processes, Quantum Operations, Examples of Quantum noise and Quantum Operations – Applications of Quantum operations, Limitations of the Quantum operations formalism, Distance Measures for Quantum information. 8 Hrs.

UNIT-V Quantum Error Correction: Introduction, Shor code, Theory of Quantum Error –Correction, Constructing Quantum Codes, Stabilizer codes, Fault – Tolerant Quantum Computation, Entropy and information – Shannon Entropy, Basic properties of Entropy, Von Neumann, Strong Sub Additivity, Data Compression, Entanglement as a physical resource . 8 Hrs.

Course Outcomes;

At the end of the course students should:

CO1: understand the quantum model of computation and the basic principles of quantum mechanics;
CO2: be familiar with basic quantum algorithms and their analysis;
CO3: be familiar with basic quantum protocols such as teleportation and super dense coding;
CO4: see how the quantum model relates to classical models of deterministic and probabilistic computation.

Text books:

1. Micheal A. Nielsen. &Issac L. Chiang, "Quantum Computation and Quantum Information", Cambridge University Press, Fint South Asian edition, 2002.

2. Eleanor G. Rieffel , Wolfgang H. Polak , "Quantum Computing - A Gentle Introduction" (Scientific and Engineering Computation) Paperback – Import, 3 Oct 2014
3. Computing since Democritus by Scott Aaronson

4. Computer Science: An Introduction by N. DavidMermin 5. Yanofsky's and Mannucci, Quantum Computing for Computer Scientists.

Course Code: BTCS719-18	**Course Title:** Quantum Computing lab	**L: T: 2P**	**Credits: 1**

1. List modern relevant quantum algorithms and their purposes.
2. Explain the key principles of the various models of quantum computation (circuit, measurement-based, adiabatic model).
3. Explain the basic structure of the quantum algorithms addressed in the course that are based on the circuit model, and to compute the outcome of basic quantum circuits.
4. Compare, in terms of time complexity, what quantum advantage is expected from the quantum algorithms addressed in the course with respect to their classical counterparts.
5. Program simple quantum algorithms on a cloud quantum computer or a cloud simulator.
6. Understand the basic principles of the continuous variable encoding for quantum information processing.
7. Give examples of the motivation for applying quantum computing to machine learning and of what the obstacles are to achieving an advantage from doing so.