1.1.3 & 1.2.1

Supporting Documents

Department of Computer Science Engineering

S. No.	Documents attached
1	Syllabus of Courses Highlighting the Focus on Employability/ Entrepreneurship/ Skill Development

Scheme & Syllabus of

Master of Technology

Computer Science & Engineering

Batch 2018 onwards

By

Board of Study- CSE

Department of Academics

IK Gujral Punjab Technical University

PROGRAM: Master of Technology in Computer Science & Engineering

It is a Post Graduate (PG) Programme of 2 years duration (4 semesters)

Courses & Examination Scheme:

<u>First Semester</u>

CourseCode	Course Type	Course Title	Load allocation L*	T*	P	Marks Distribution Internal	External	Total Marks	Credits
MTCS 101-18	Program Core I	Mathematical foundations of Computer Science	3	0	0	40	60	100	3
MTCS 102-18	Program Core II	Advanced Data Structures	3	0	0	40	60	100	3
MTCS 105-18	Program Elective I	Machine Learning	3	0	0	40	60	100	3
MTCS 106-18		Wireless Sensor Networks							
MTCS 107-18		Introduction toIntelligent Systems							
MTCS 108-18	Program Elective II	Data Science	3	0	0	40	60	100	3
MTCS 109-18		Distributed Systems							
MTCS 110-18		Advanced Wireless and Mobile Networks							
MTRM 101-18		Research Methodology and IPR	2	0	0	40	60	100	2
MTA-xx	Audit Course **		2	0	0	0	0	0	0
MTCS 103-18	Laboratory 1	Advanced Data Structures Lab.	0	0	4	60	40	100	2
MTCS 104-18	Laboratory 2	Based on Electives	0	0	4	60	40	100	2
	TOTAL		**16**	**0**	**8**	**320**	**380**	**700**	**18**

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

Second Semester

Course Code	Course Type	Course Title	Load allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MTCS 201-18	Program Core III	Advance Algorithms	3	0	0	40	60	100	3
MTCS 202-18	Program Core IV	Soft Computing	3	0	0	40	60	100	3
MTCS 206-18	Program Elective III	Data Preparation and Analysis	3	0	0	40	60	100	3
MTCS 207- 18		Secure Software Design &Enterprise Computing							
MTCS 208-18		Computer Vision							
MTCS 209-18	Program Elective IV	Human and Computer Interaction	3	0	0	40	60	100	3
MTCS 210-18		GPU Computing							
MTCS 211-18		Digital Forensics							
MTA-xxx	Audit Course**		2	0	0	0	0	0	0
MTCS 203-18	Laboratory 3	Based on cores	0	0	4	60	40	100	2
MTCS 204-18	Laboratory 4	Based on Electives	0	0	4	60	40	100	2
MTCS 205-18		Mini Project with Seminar	2	0	0	60	40	100	2
	TOTAL		**16**	**0**	**8**	**320**	**380**	**700**	**18**

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

Third Semester

CourseCode	Course Type	Course Title	Load allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MTCS 302-18	Program Elective V	Mobile Applications and Services	3	0	0	40	60	100	03
MTCS 303-18		Compiler for HPC							
MTCS 304-18		Optimization Techniques							
MTOE 301-18	Open Elective	1.Business Analytics	3	0	0	40	60	100	03
MTOE 302-18		Industrial Safety							
MTOE 303-18		Operations Research							
MTOE 304-18		Cost Managementof Engineering Projects							
MTOE 305-18		Composite Materials							
MTOE 306-18		Waste to Energy							
MTCS 301-18	Dissertation -I		0	0	20	60	40	100	7
MTCS 305-18	Training**	Industry/ Institutional	0	0	0	60	40	100	3
	TOTAL		**6**	**0**	**20**	**200**	**200**	**400**	**16**

** This is to be taken up after 2nd semester, for 6-8 weeks in summer, in industry / institution of repute.

Fourth Semester

CourseCode	Course Type	Course Title	Load allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
MTCS 401-18	Thesis	Dissertation - II	0	0	32	60	40	100	16
	TOTAL		0	0	32	60	40	100	16

*A course can either have four Hrs Lecture or Three Hrs Lecture + One Hrs Tutorial as per requirement

Total Marks of M. Tech Program:1800

Total Credit of M. Tech Program:68

**** Audit courses:**

COURSE CODE: MTA-xxx

A01. English for Research Paper Writing
A02. Disaster Management
A03. Sanskrit for Technical Knowledge
A04. ValueEducation
A05. Constitution of India
A06. Pedagogy Studies
A07. Stress Management by Yoga
A08. Personality Development through Life Enlightenment Skills.

Program Outcomes of CSE (M.Tech.) program: 2018 onwards

The main outcomes of the CSE (M.Tech.)program are given here. At the end of the program a student is expected to have:

1. An understanding of the theoretical foundations and the limits of computing.

2.An ability to adapt existing models, techniques, algorithms, data structures, etc. for efficiently solving problems.

3.An ability to design,develop and evaluate new computer based systems for novel applications which meet thedesired needs of industry and society.

4.Understanding and ability to use advanced computing techniques and tools.

5.An ability to undertake original research at the cutting edge of computer science & its related areas.

6.An ability to function effectively individually or as a part of a team to accomplish a stated goal.

7. An understanding of professional and ethical responsibility.

8. An ability to communicate effectively with a wide range of audience.

9. An ability to learn independently and engage in life long learning.

10.An understanding of the impact of IT related solutions in an economic, social and environment context.

Syllabus, course objective and course outcomes for various M.TECH -CSE Subjects:

Course Code	MTCS101-18
Course Name	Mathematical Foundation of Computer Science
Credits	3
Pre-Requisites	Discrete Mathematics

Total Number of Lectures:48

COURSE OBJECTIVE

- To understand the mathematical fundamentals that is prerequisites for avariety of courses like Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.
- To developthe understanding ofthe mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.
- To study various sampling and classification problems.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1 Probability mass, density, and cumulative distribution functions, Parametric families of distributions, Expected value, variance, conditional expectation, Applications of the univariate and multivariate Central Limit Theorem, Probabilistic inequalities, Markovchains.	7
Unit 2 Random samples, sampling distributions of estimators**,** Methods of Moments and Maximum Likelihood.	7
Unit 3 Statistical inference**,** Introduction to multivariate statistical models: regression and classification problems, principal components analysis**,** The problem of overfitting model assessment.	8
Unit 4 Graph Theory: Isomorphism, Planar graphs, graph coloring, Hamilton circuits and Euler cycles. Permutations and Combinations with and without repetition. Specialized techniques to solve combinatorial enumeration problems.	11

Unit 5 **Computer science and engineering applications** Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.	10
Unit 6 Recent Trends in various distribution functions in mathematical field of computerscience for varying fields like bioinformatics, soft computing, and computer vision.	5

COURSE OUTCOMES
After completion of course, students would be able to:
0 To understand the basic notions of discrete and continuous probability.
0 To understand the methods of statistical inference, and the role that sampling distributions play in those methods.
0 To be able to perform correct and meaningful statistical analyses of simple to moderate complexity.

References:

1. John Vince, Foundation Mathematics for Computer Science, Springer.
2. K. Trivedi.Probability and Statistics with Reliability, Queuing, and Computer Science Applications. Wiley.
3. M. Mitzenmacher and E. Upfal.Probability and Computing: Randomized Algorithms and Probabilistic Analysis.
4. Alan Tucker, Applied Combinatorics, Wiley

Course Code	MTCS102-18
Course Name	Advanced Data Structures
Credits	3
Pre-Requisites	UG level course in Data Structures

Total Number of Lectures:48

COURSE OBJECTIVE
0 The student should be able to choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.
0 Students should be able to understand the necessary mathematical abstraction to solve problems.

0 To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.	
0 Student should be able to come up with analysis of efficiency and proofs of correctness.	
LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1 **Dictionaries:** Definition, Dictionary Abstract Data Type, Implementation of Dictionaries. **Hashing:** Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic, Probing, Double Hashing, Rehashing, Extendible Hashing.	7
Unit 2 **Skip Lists:** Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	5
Unit 3 **Trees:** Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	9
Unit 4 **Text Processing:** Sting Operations, Brute-Force Pattern Matching, The Boyer-Moore Algorithm, The Knuth-Morris-Pratt Algorithm, Standard Tries, Compressed Tries, Suffix Tries, The Huffman Coding Algorithm, The Longest Common Subsequence Problem (LCS), Applying Dynamic Programming to the LCS Problem.	12
Unit 5 **Computational Geometry:** One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadtrees, k-D Trees.	10
Unit 6 Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.	5

COURSE OUTCOMES
After completion of course, students would be able to:
0 Understand the implementation of symbol table using hashing techniques.
0 Develop and analyze algorithms for red-black trees, B-trees and Splay trees.
0 Develop algorithms for text processing applications.
0 Identify suitable data structures and develop algorithms for computational geometry problems.

References:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, 2nd Edition, Pearson, 2004.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.

Course Code	MTCS201-18
Course Name	Advanced Algorithms
Credits	3
Pre-Requisites	UG level course in Algorithm Design and Analysis

Total Number of Lectures:48

COURSE OBJECTIVE
0 Introduce students to the advanced methods of designing and analyzing algorithms.
0 The student should be able to choose appropriate algorithms and use it for a specific problem.
0 To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.
0 Students should be able to understand different classes of problems concerning their computation difficulties.
0 To introduce the students to recent developments in the area of algorithmic design.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit1 **Sorting:** Review of various sorting algorithms, topological sorting **Graph:** Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkasra's), depth-first search and computation of strongly connected components, emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.	6
Unit 2 **Matroids:** Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST. **Graph Matching:** Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.	8

Unit 3 **Flow-Networks:** Maxflow-mincut theorem, Ford-Fulkerson Method to compute maximum flow, Edmond-Karp maximum-flow algorithm. **Matrix Computations:** Strassen's algorithm and introduction to divide and conquer paradigm, inverse of a triangular matrix, relation between the time complexities of basic matrix operations, LUP-decomposition.	9
Unit 4 **Shortest Path in Graphs:** Floyd-Warshall algorithm and introduction to dynamic programming paradigm. More examples of dynamic programming. **Modulo Representation of integers/polynomials:** Chinese Remainder Theorem, Conversion between base-representation and modulo-representation. Extension to polynomials. Application: Interpolation problem. **Discrete Fourier Transform (DFT):** In complex field, DFT in modulo ring. Fast Fourier Transform algorithm. Schonhage-Strassen Integer Multiplication algorithm.	10
Unit 5 **Linear Programming:** Geometry of the feasibility region and Simplex algorithm. **NP-completeness:** Examples, proof of NP-hardness and NP-completeness. **One or more of the following topics based on time and interest** Approximation algorithms, Randomized Algorithms, Interior Point Method, Advanced Number Theoretic Algorithm.	10
Unit 6 Recent Trands in problem solving paradigms using recent searching and sorting techniques by applying recently proposed data structures.	5

COURSE OUTCOMES
After completion of course, students would be able to: 0 Analyze the complexity/performance of different algorithms.
0 Determine the appropriate data structure for solving a particular set of problems.
0 Categorize the different problems in various classes according to their complexity.
0 Students should have an insight of recent activities in the field of the advanced data structure.

References:

1. "Introduction to Algorithms" by Cormen, Leiserson, Rivest, Stein.
2. "The Design and Analysis of Computer Algorithms" by Aho, Hopcroft, Ullman.
3. "Algorithm Design" by Kleinberg and Tardos.

Research Methodology and IPR	
Course Code: MTRM-101-18, Credits :2 Lectures: 1hrs/week	

Course Outcomes:

At the end of this course, students will be able to

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Contents:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem.

Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper

Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

References:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & engineering students’”
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”
3. Ranjit Kumar, 2nd Edition , “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd, 2007.
5. Mayall , “Industrial Design”, McGraw Hill, 1992.
6. Niebel , “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008

Course Code	MTCS202-18
Course Name	Soft Computing
Credits	3
Pre-Requisites	Basic knowledge of mathematics

TotalNumberofLectures: 48

COURSE OBJECTIVE
0 To introduce soft computing concepts and techniques and foster their abilities in designing appropriate technique for a given scenario.
0 To implement soft computing based solutions for real-world problems.
0 To give students knowledge of non-traditional technologies and fundamentals of artificial neural networks, fuzzy sets, fuzzy logic, genetic algorithms.
0 To provide student hand-on experience on MATLAB to implement various strategies.

LECTURE WITH BREAKU	**NO. OF LECTURES**
Unit 1: **INTRODUCTION TOSOFTCOMPUTING ANDNEURALNETWORKS:** Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	7
Unit 2 **FUZZY LOGIC:** Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.	8
Unit 3 **NEURAL NETWORKS:** Machine Learning Using Neural Network, Adaptive Networks, Feed forward Networks, Supervised Learning Neural Networks, Radial Basis Function Networks : Reinforcement Learning, Unsupervised Learning Neural Networks, Adaptive Resonance architectures, Advances in Neural networks	10
Unit 4 **GENETIC ALGORITHMS:** Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	5
Unit 5 **Matlab/Python Lib:** Introduction to Matlab/Python, Arrays and array operations, Functions and Files, Study of neural network toolbox and fuzzy logic toolbox, Simple implementation of Artificial Neural Network and Fuzzy Logic.	13

Unit 6 Recent Trands in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	5

COURSE OUTCOMES	
After completion of course, students would be able to:	
0	Identify and describe soft computing techniques and their roles in building intelligent machines
0	Apply fuzzy logic and reasoning to handle uncertainty and solve various engineering problems.
0	Apply genetic algorithms to combinatorial optimization problems.
0	Evaluate and compare solutions by various soft computing approaches for a given problem.

References:

1. Jyh:Shing Roger Jang, Chuen:Tsai Sun, EijiMizutani, Neuro:Fuzzy and Soft Computing17, Prentice:Hall of India, 2003.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic:Theory and Applications17, Prentice Hall, 1995.
3. MATLAB Toolkit Manual

ELECTIVE SUBJECTS

Course Code	MTCS 105-18
Course Name	Machine learning
Credits	3
Pre-Requisites	

Total Number of Lectures:48

COURSE OBJECTIVE
0 To learn the concept of how to learn patterns and concepts from data without being explicitly programmed in various IOT nodes.
0 To design and analyse various machine learning algorithms and techniques with a modern outlook focusing on recent advances.
0 Explore supervised and unsupervised learning paradigms of machine learning.
0 To explore Deep learning technique and various feature extraction strategies.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: **Supervised Learning (Regression/Classification)** 0 Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes 0 Linear models: Linear Regression, Logistic Regression, Generalized Linear Models 0 Support Vector Machines, Nonlinearity and Kernel Methods 0 Beyond Binary Classification: Multi-class/Structured Outputs, Ranking	10

Unit 2: **Unsupervised Learning** • Clustering: K-means/Kernel K-means • Dimensionality Reduction: PCA and kernel PCA • Matrix Factorization and Matrix Completion • Generative Models (mixture models and latent factor models)	7
Unit 3 Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, RandomForests).	6
Unit 4 Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.	9
Unit 5 Scalable Machine Learning (Online and Distributed Learning) A selection from some other advanced topics, e.g., Semi-supervised Learning, Active Learning, Reinforcement Learning, Inference in Graphical Models, Introduction to Bayesian Learning and Inference.	9
Unit 6: Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.	5

COURSE OUTCOMES
After completion of course, students would be able to:
0 Extract features that can be used for a particular machine learning approach in various IOT applications.
0 To compare and contrast pros and cons of various machine learning techniques and to get an insight of when to apply a particular machine learning approach.
0 To mathematically analyse various machine learning approaches and paradigms.

References:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012

2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning, Springer 2009 (freely available online)
3. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2007.

Course Code	MTCS106-18
Course Name	Wireless Sensor Networks
Credits	3
Pre-Requisites	Wireless Communication

Total Number of Lectures: 48

COURSE OBJECTIVE
0 Architect sensor networks for various application setups.
0 Devise appropriate data dissemination protocols and model links cost.
0 Understanding of the fundamental concepts of wireless sensor networks and have a basic knowledge of the various protocols at various layers.
0 Evaluate the performance of sensor networks and identify bottlenecks.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Introduction to Wireless Sensor Networks:** Course Information, Introduction to Wireless Sensor Networks: Motivations, Applications, Performance metrics, History and Design factors **Network Architecture:** Traditional layered stack, Cross-layer designs, Sensor Network Architecture **Hardware Platforms:** Motes, Hardware parameters	9
Unit 2: **Introduction to ns-3: I**ntroduction to Network Simulator 3 (ns-3), Descriptionof the ns-3 core module and simulation example.	9
Unit 3: **Medium Access Control Protocol design:** Fixed Access, Random Access, WSN protocols: synchronized, duty-cycled **Introduction to Markov Chain:** Discrete time Markov Chain definition, properties, classification and analysis **MAC Protocol Analysis:** Asynchronous duty-cycled. X-MAC Analysis (Markov Chain)	8

Unit 4: **Security**: Possible attacks, countermeasures, SPINS, Static and dynamic key distribution.	8
Unit 5: **Routing protocols:** Introduction, MANET protocols **Routing protocols for WSN**: Resource-aware routing, Data-centric, Geographic Routing, Broadcast, Multicast **Opportunistic Routing Analysis**: Analysis of opportunistic routing (Markov Chain) Advanced topics in wireless sensor networks.	10
Unit 6: **ADVANCED TOPICS** Recent development in WSN standards, software applications.	4

COURSE OUTCOMES
After completion of course, students would be able to:
0 Describe and explain radio standards and communication protocols for wireless sensor networks.
0 Explain the function of the node architecture and use of sensors for various applications.
0 Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.

References:

1. W. Dargie and C. Poellabauer, “Fundamentals of Wireless Sensor Networks –Theory and Practice”, Wiley 2010
2. KazemSohraby, Daniel Minoli and TaiebZnati, “wireless sensor networks -Technology, Protocols, and Applications”, Wiley Interscience 2007
3. Takahiro Hara,Vladimir I. Zadorozhny, and Erik Buchmann, “Wireless Sensor Network Technologies for the Information Explosion Era”, springer 2010

Course Code	MTCS107-18
Course Name	Introduction to Intelligent Systems
Credits	3
Pre-Requisites	Data Structures and Data Management or Data Structures

Total Number of Lectures: 48

COURSEOBJECTIVE
0 Theaim ofthecourseistointroducetothefieldofArtificialIntelligence(AI)withemphasisonitsusetosolvereal worldproblemsforwhichsolutionsaredifficulttoexpressusingthetraditionalalgorithmicapproach.It explorestheessentialtheorybehindmethodologiesfordevelopingsystemsthatdemonstrateintelligent behaviourincludingdealingwithuncertainty,learning from experience and following problem solving

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.	9
Unit 2: Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.	6
Unit 3: Search Methods Basic concepts of graph and tree search. Three simple search methods: breadth-first search, depth-first search, iterative deepening search. Heuristic search methods: best-first search, admissible evaluation functions, hill- climbing search. Optimization and search such as stochastic annealing and genetic algorithm.	7
Unit 4: Knowledge representation and logical inference Issues in knowledge representation. Structured representation, such as frames, and scripts, semantic networks and conceptual graphs. Formal logic and logical inference. Knowledge-based systems structures, its basic components. Ideas of Blackboard architectures.	9
Unit 5: Reasoning under uncertainty and Learning Techniques on uncertainty reasoning such as Bayesian reasoning, Certainty factors and Dempster-Shafer Theory of Evidential reasoning, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.	7

Unit 6: Recent trends in Fuzzy logic, Knowledge Representation.	5

COURSE OUTCOMES
After completion of course, students would be:
0 Able to demonstrate knowledge of the fundamental principles of intelligent systems and would be able to analyses and compare the relative merits of a variety of AI problem solving techniques.

References:

1. Luger G.F. and Stubblefield W.A. (2008). Artificial Intelligence: Structures and strategies for Complex Problem Solving. Addison Wesley, 6th edition.
2. Russell S. and Norvig P. (2009). Artificial Intelligence: A Modern Approach. Prentice-Hall, 3rd edition.

Course Code	MTCS108-18
Course Name	Data Science
Credits	3
Pre-Requisites	

Total Number of Lectures:48

COURSEOBJECTIVE
0 Provide you with the knowledge and expertise to become a proficient data scientist.
0 Demonstrate an understanding of statistics and machine learning concepts that are vital for data science;
0 Produce Python code to statistically analyses a dataset;
0 Critically evaluate data visualizations based on their design and use for communicating stories from data;

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	6
Unit 2: Data collection and management: Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, Using multiple data sources.	7
Unit 3: Data analysis: Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.	10
Unit 4: Data visualization:Introduction, Types of data visualization,Data for visualization:Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	11
Unit 5: Applications of Data Science,Technologies for visualization, Bokeh (Python)	7
Unit 6: Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	7

COURSE OUTCOMES

On completion of the course the student should be able to
0 Explain how data is collected, managed and stored for data science;
0 Understand the key concepts in data science, including their real-world applications and the toolkit used by data scientists;
0 Implement data collection and management scripts using MongoDB

References:

1. Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk fromthe Frontline. O'Reilly.

2. Jure Leskovek, Annand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

Course Code	MTCS109-18
Course Name	Distributed Systems
Credits	3
Pre-Requisites	Database Management Systems

Total Number of Lectures: 48

COURSEOBJECTIVE
• Tointroducethefundamentalconceptsandissuesofmanaginglargevolumeofshareddatainaparallelanddistributedenvironment,andtoprovideinsightintorelatedresearchproblems.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
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; Globaldirectory issues.	8

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.	11
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.	11
Unit 4: **RELIABILITY** Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.	8
Unit 5: **PARALLEL DATABASE SYSTEMS** Parallel architectures; parallel query processing and optimization; load balancing.	6

Unit 6: **ADVANCED TOPICS** Mobile Databases, Distributed Object Management, Multi-databases.	4

COURSE OUTCOMES
After completion of course, students would be:
0 Design trends in distributed systems.
0 Apply network virtualization.
0 Apply remote method invocation and objects.

References:

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	MTCS110-18
Course Name	Advanced Wireless and Mobile Networks
Credits	3
Pre-Requisites	Computer Networks

Total Number of Lectures: 48

COURSE OBJECTIVE
0 The students should get familiar with the wireless/mobile market and the future needs and challenges.
0 To get familiar with key concepts of wireless networks, standards, technologies and their basic operations
0 To learn how to design and analyse various medium access
0 To learn how to evaluate MAC and network protocols using network simulation software tools.
0 The students should get familiar with the wireless/mobile market and the future needs and challenges.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: INTRODUCTION: Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies -CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. **WIRELESS LOCAL AREA NETWORKS:** IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF& PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.	11
Unit 2: **WIRELESS CELLULAR NETWORKS:** 1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.	10
Unit 3: WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview **WIRELESS SENSOR NETWORKS** Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.	8
Unit 4: WIRELESS PANs Bluetooth AND Zigbee, Introduction to Wireless Sensors.	4
Unit 5: SECURITY Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.	10

Unit 6: **ADVANCED TOPICS** IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks	5

COURSE OUTCOMES
After completion of course, students would be:
0 Demonstrate advanced knowledge of networking and wireless networking and understand various types of wireless networks, standards, operations and use cases.
0 Be able to design WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
0 Demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
0 Design wireless networks exploring trade-offs between wire line and wireless links.
0 Develop mobile applications to solve some of the real world problems.

References:

1. Schiller J., Mobile Communications, Addison Wesley 2000
2. Stallings W., Wireless Communications and Networks, Pearson Education 2005
3. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons Inc 2002
4. Yi Bing Lin and ImrichChlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc 2000
5. Pandya Raj, Mobile and Personal Communications Systems and Services, PHI 200

Course Code	MTCS206-18
Course Name	Data Preparation and Analysis
Credits	3
Pre-Requisites	

Total Number of Lectures: 48

COURSEOBJECTIVE
• Topreparethedataforanalysisanddevelop meaningfulDataVisualizations

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit1: **Data Gathering and Preparation:** Data formats, parsing and transformation, Scalability and real-time issues.	9
Unit2: **Data Cleaning:** Consistency checking, Heterogeneous and missing data, Data Transformation and segmentation.	11
Unit3: **Exploratory Analysis:** Descriptive and comparative statistics, Clustering and association, Hypothesis generation.	13
Unit4: Visualization: Designing visualizations, Time series, Geolocated data, Correlations and connections, Hierarchies and networks, interactivity.	15

COURSE OUTCOMES
After completion of course, students would be:

0 Able to extract the data for performing the Analysis.

References:

1. Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining, by Glenn J. Myatt

Course Code	MTCS207-18
Course Name	Secure Software Design and Enterprise Computing
Credits	3
Pre-Requisites	Computer Programming, Software Engineering

Total Number of Lectures:48

COURSE OBJECTIVE
0 To fix software flaws and bugs in various software.
0 To make students aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
0 Techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment.
0 Methodologies and tools to design and develop secure software containing minimum vulnerabilities and flaws.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: **Secure Software Design** Identify software vulnerabilities and perform software security analysis, Mastersecurity programming practices, Master fundamental software security design concepts, Perform security testing and quality assurance.	8

Unit 2: **Enterprise Application Development** Describe the nature and scope of enterprise software applications, Design distributed N-tier software application, Research technologies available for the presentation, business and data tiers of an enterprise software application, Design and build a database using an enterprise database system, Develop components at the different tiers in an enterprise system, Design and develop a multi-tier solution to a problem using technologies used in enterprise system, Present software solution.	11
Unit 3: **Enterprise Systems Administration** Design, implement and maintain a directory-based server infrastructure in a heterogeneous systems environment, Monitor server resource utilization for system reliability and availability, Install and administer network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).	8
Unit 4: Obtain the ability to manage and troubleshoot a network running multiple services, Understand the requirements of an enterprise network and how to go about managing them.	8
Unit 5: Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.	9
Unit 6: Case study of DNS server, DHCP configuration and SQL injection attack.	4

COURSE OUTCOMES
After completion of course, students would be able to:
0 Differentiate between various software vulnerabilities.
0 Software process vulnerabilities for an organization.
0 Monitor resources consumption in a software.
0 Interrelate security and software development process.

References:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley.

Course Code	MTCS208-18
Course Name	Computer Vision
Credits	3
Pre-Requisites	Linear algebra, vector calculus, Data structures and Programming.

Total Number of Lectures: 48

COURSE OBJECTIVE
0 Be familiar with both the theoretical and practical aspects of computing with images.
0 Have described the foundation of image formation, measurement, and analysis.
0 Understandthegeometricrelationshipsbetween2Dimagesandthe3Dworld.
0 Grasptheprinciplesofstate-of-the-art deepneuralnetworks.

LECTURE WITH BREAKUP	**NO. OF LECTURES**
Unit 1: Overview, computer imaging systems, lenses, Image formation and sensing, Image analysis, pre-processing and Binary image analysis.	8
Unit 2: Edge detection, Edge detection performance, Hough transform, corner detection.	9
Unit 3: Segmentation, Morphological filtering, Fourier transform.	9
Unit 4: Feature extraction, shape, histogram, color, spectral, texture, using CVIPtools, Feature analysis, feature vectors, distance /similarity measures, data pre- processing.	9

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.	9
Unit 6: Recent trends inActivity Recognition, computational photography, Biometrics.	4

COURSE OUTCOMES
After completion of course, students would be able to:
0 Developed the practical skills necessary to build computer vision applications.
0 To have gained exposure to object and scene recognition and categorization from images.

References:

1. Computer Vision: Algorithms and Applications by Richard Szeliski.
2. Deep Learning, by Goodfellow, Bengio, and Courville.
3. Dictionary ofComputer VisionandImageProcessing,by Fisheretal.

Course Code	MTCS209-18
Course Name	Human and Computer Interaction
Credits	3
Pre-Requisites	

Total Number of Lectures: 48

COURSEOBJECTIVE
0 LearnthefoundationsofHumanComputerInteraction 0 Be familiar withthedesigntechnologies forindividualsandpersonswithdisabilities 0 BeawareofmobileHumanComputerinteraction. 0 Learntheguidelines foruserinterface.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models– frameworks – Ergonomics – styles – elements – interactivity- Paradigms.	9
Unit 2: Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules– principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.	12
Unit 3: Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and WWW.	8
Unit 4: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.	8
Unit 5: Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8
Unit 6: Recent Trends: Speech Recognition and Translation, Multimodal System.	3

COURSE OUTCOMES
After completion of course, students would be:

- Understand the structure of models and theries of human computer interaction and vision.\
- Design an interactive web interface on the basis of models studied.

References:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, “Human Computer Interaction”, 3rd Edition, Pearson Education, 2004 (UNIT I , II & III)
2. Brian Fling, “Mobile Design and Development”, First Edition , O17Reilly Media Inc., 2009 (UNIT – IV)
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O17Reilly, 2009.(UNIT-V)

Course Code	MTCS210-18
Course Name	GPU Computing
Credits	3
Pre-Requisites	

Total Number of Lectures: 48

COURSE OBJECTIVE
To learn parallel programming with Graphics Processing Units (GPUs).

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: **Introduction**: History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC,Hello World Computation Kernels, Launch parameters, Thread hierarchy,	
Warps/ Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D/ 3D thread mapping, Device properties, Simple Programs. **Unit 2:** **Memory**: Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-	13

dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories.	7

Unit 3: **Synchronization**: Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU **Functions**: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.	10
Unit 4: **Support**: Debugging GPU Programs. Profiling, Profile tools, Performance aspects **Streams**: Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.	8
Unit 5: **Case Studies**: Image Processing, Graph algorithms, Simulations, Deep Learning.	5
Unit 6: **Advanced topics**: Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.	5

COURSE OUTCOMES
After completion of course, students would be:
0 Students would learnconcepts in parallel programming, implementation of programs on GPUs, debugging and profiling parallel programs.

References:

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-meiHwu; Morgan Kaufman; 2010 (ISBN: 978-0123814722)
2. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN: 978-0124159334)

Course Code	MTCS211-18
Course Name	Digital Forensics
Credits	3
Pre-Requisites	Cybercrime and Information Warfare, Computer Networks

Total Number of Lectures: 48

COURSEOBJECTIVE
0 Providesanin-depthstudyoftherapidlychangingandfascinating fieldofcomputerforensics.
0 Combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.
0 Knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools.
0 E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: **Digital Forensics Science:** Forensics science, computer forensics, and digital forensics. **Computer Crime:** Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.	9
Unit 2: **Cyber Crime Scene Analysis:** Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.	8
Unit 3: **Evidence Management & Presentation:** Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.	9
Unit 4: **Computer Forensics:** Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case, **Network Forensics:** open-source security tools for network forensic analysis, requirements for preservation of network data.	10

Unit 5: **Mobile Forensics:** mobile forensics techniques, mobile forensics tools. **Legal Aspects of Digital Forensics:** IT Act 2000, amendment of IT Act 2008.	8
Unit 6: Recent trends in mobile forensic technique and methods to search and seizure electronic evidence.	4

COURSE OUTCOMES
After completion of course, students would be able to:
0 Understand relevant legislation and codes of ethics
0 Computer forensics and digital detective and various processes, policies and procedures
0 E-discovery, guidelines and standards, E-evidence, tools and environment.
0 Email and web forensics and network forensics

References:

1. John Sammons, The Basics of Digital Forensics, Elsevier
2. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications

Course Code	MTCS302-18
Course Name	Mobile Applications and Services
Credits	3
Pre-Requisites	Wireless Communication and Mobile Computing

Total Number of Lectures:48

COURSE OBJECTIVE
0 This course presents the three main mobile platforms and their ecosystems, namely Android, iOS, and PhoneGap/WebOS.
0 It explores emerging technologies and tools used to design and implement feature-rich mobile applications for smartphones and tablets.
0 It also take into account both the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: **Introduction**:Introduction to Mobile Computing, Introduction to Android Development Environment, Factors in Developing Mobile Applications, Mobile Software Engineering, Frameworks and Tools, Generic UI Development Android User.	8
Unit 2: **More on Uis**: VUIs and Mobile Apps, Text-to-Speech Techniques, Designing the Right UI, Multichannel and Multimodal Uis,.Storing and Retrieving Data, Synchronization and Replication of Mobile Data, Getting the Model Right, Android Storing and Retrieving Data, Working with a Content Provider.	8
Unit 3: **Communications via Network and the Web:**State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony. **Notifications and Alarms**:Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.	10
Unit 4: **Putting It All Together**: Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android. **Multimedia**: Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.	9
Unit 5: **Platforms and Additional Issues**: Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android.	8
Unit 6: Recent trends inCommunication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.	5

COURSEOUTCOMES
0 Oncompletionofthecoursethestudent should beabletoidentify the target platform and users and be able to define and sketch a mobile application.

0	Understand the fundamentals, frameworks, and development lifecycle of mobile application platforms including iOS, Android, and PhoneGap.
0	Design and develop a mobile application prototype in one of the platform (challenge project)

References:

1. Wei-Meng Lee, Beginning Android™ 4 Application Development, 2012 by John Wiley & Sons

Course Code	MTCS303-18
Course Name	Compiler for HPC
Credits	3
Pre-Requisites	Data Structure, Compiler Design, Theory of Computation

Total Number of Lectures: 48

COURSEOBJECTIVE
• Theobjectiveofthiscourseistointroducestructureofcompilersandhighperformancecompilerdesignf orstudents.Conceptsof cachecoherenceandparallelloopsincompilersareincluded.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit1: **High Performance Systems,** Structure of a Compiler, Programming Language Features, Languages for High Performance.	7
Unit2: **Data Dependence:** Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. **Scalar Analysis with Factored Use-Def Chains:** Constructing Factored Use- Def Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.	7

Unit3: Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. **Loop Restructuring:** Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. **Optimizing for Locality:** Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.	10
Unit4: **Concurrency Analysis:** Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. **Vector Analysis:** Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.	10
Unit5: **Message-Passing Machines:** SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. **Scalable Shared-Memory Machines:** Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.	10
Unit 6: Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.	4

COURSE OUTCOMES
After completion of course, students would be:
0 Familiar with the structure of compiler. 0 Parallel loops, data dependency and exception handling and debugging in compiler.

References:

1. Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson

Course Code	MTCS304-18
Course Name	Optimization Techniques
Credits	3
Pre-Requisites	Linear Algebra and Numerical Methods

Total Number of Lectures: 48

COURSEOBJECTIVE
0 Theobjectiveofthiscourseistoprovideinsighttothemathematicalformulationofrealworldproblems. 0 Tooptimizethesemathematicalproblemsusingnaturebasedalgorithms.Andthesolutionisusefulespeciallyfor NP-Hardproblems.

LECTURE WITH BREAKUP	NO. OF LECTURES
Unit 1: Engineering application of Optimization, Formulation of design problems as mathematical programming problems.	7
Unit 2: General Structure of Optimization Algorithms, Constraints, The Feasible Region.	7
Unit 3: Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.	11
Unit 4: Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.	12

Unit 5: Real life Problems and their mathematical formulation as standard programming problems.	6
Unit 6: Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.	5

COURSE OUTCOMES
After completion of course, students would be:
0 Formulate optimization problems.
0 Understand and apply the concept of optimality criteria for various types of optimization problems.
0 Solve various constrained and unconstrained problems in Single variable as well as multivariable.
0 Apply the methods of optimization in real life situation.

References:

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.
2. Practical Optimization Algorithms and Engineering Applications Andreas Antoniou.
3. An Introduction to Optimization Edwin K., P. Chong & Stanislaw h. Zak.
4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006). Integer programming: theory and practice.CRC Press. ISBN 978-0-8493- 1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3- 540-68274-5.
8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

OPEN ELECTIVES

Business Analytics

Teaching scheme Lecture: - 3 h/week

Course Code	MTOE301-18
Course Name	**Business Analytics**
Credits Prerequisites	

Total Number of Lectures: 48

Courseobjective
1. Understandtheroleofbusinessanalyticswithinanorganization. 2. Analyzedatausingstatisticalanddataminingtechniquesandunderstandrelationshipsbetweenthe underlying businessprocessesofanorganization. 3. Togainanunderstandingofhowmanagersusebusinessanalyticstoformulateandsolvebusinessproblemsandto supportmanagerialdecisionmaking. 4. Tobecomefamiliar withprocessesneededtodevelop, report,andanalyzebusinessdata. 5. Usedecision-makingtools/Operationsresearchtechniques. 6. Mangebusinessprocessusinganalyticaland managementtools. 7. Analyzeandsolveproblemsfromdifferent industriessuchasmanufacturing,service,retail,software,bankingandfinance,sports,pharmaceutical,aerospaceetc.

LECTURE WITH BREAKUP	NO. OFLECTURES
Unit1: Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.	9
Unit 2: Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
Unit 3: Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.	9
Unit 4: Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation UsingAnalytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10

Unit 5: Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.	8
Unit 6: Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.	4

COURSE OUTCOMES	
1.	Students will demonstrate knowledge of data analytics.
2.	Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
3.	Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
4.	Students will demonstrate the ability to translate data into clear, actionable insights.

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

2. Business Analytics by James Evans, persons Education.

OPEN ELECTIVES

Industrial Safety

Teaching scheme Lecture: - 3 h/week

Unit-I: Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc., Safety color codes. Fire prevention and firefighting, equipment and methods.

Unit-II: Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Unit-III: Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications,

i. Screw down grease cup,
ii. Pressure grease gun,
iii. Splash lubrication,
iv. Gravity lubrication,
v. Wick feed lubrication
vi. Side feed lubrication,
vii. Ring lubrication,

Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Unit-IV: Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like,

I. Any onemachine tool,
AI. Pump,
BI. Air compressor,

IV. Internal combustion engine,
V. Boiler,

VI. Electrical motors,

Types of faults in machine tools and their general causes.

Unit-V: Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.

3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

OPEN ELECTIVES

Operations Research

Teaching Scheme Lectures: 3 hrs/week

Course Outcomes:

At the end of the course, the student should be able to:

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

Syllabus Contents: Unit 1:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

Unit 2

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

Unit 3:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

Unit 4

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

Unit 5

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008.
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009.
5. Pannerselvam, Operations Research: Prentice Hall of India 2010.
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010.

Open Elective

Cost Management of Engineering Projects

Teaching scheme

Lecture: - 3 h/week

Introduction and Overview of the Strategic Cost Management Process.

Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality

Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis. Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

References:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Open Elective Composite Materials

Teaching Scheme
Lecture: 3h/week

UNIT–I: INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT – II: REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT – III: Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT–IV: Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT – V: Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.

2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition, 2007.

References:

1. Hand Book of Composite Materials-ed-Lubin.

2. Composite Materials – K.K.Chawla.

3. Composite Materials Science and Applications – Deborah D.L. Chung.

4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Open Elective Waste to Energy

Teaching Schema
Lecture: 3h/week

Unit-I: Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit-II: Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit-III: Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit-IV: Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit-V: Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

References:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

Course objectives:

Students will be able to:

Understand that how to improve your writing skills and level of readability

Learn about what to write in each section

Syllabus

Units	CONTENTS	Hours
1	Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	4
2	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction	4
3	Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check.	4
4	key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature,	4
5	skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions	4
6	useful phrases, how to ensure paper is as good as it could possibly be the first- time submission	4

Suggested Studies:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman'sbook
.

4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

AUDIT 1 and 2: DISASTER MANAGEMENT

Course Objectives: -Students will be able to:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

Syllabus

Units	CONTENTS	Hours
1	**Introduction** Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	**Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.	4
3	**Disaster Prone Areas In India** Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics	4

4	**Disaster Preparedness And Management** Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness.	4
5	**Risk Assessment** Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co- Operation In Risk Assessment And Warning, People's Participation In Risk Assessment. Strategies for Survival.	4
6	**Disaster Mitigation** Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.	4

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.
4.

AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Objectives

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects
4. enhancing the memory power

5. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Syllabus

Unit	Content	Hours
1	• Alphabets in Sanskrit, • Past/Present/Future Tense, • Simple Sentences	8
2	• Order • Introduction of roots • Technical information about Sanskrit Literature	8
3	• Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics	8

Suggested reading

1. “Abhyaspustakam” – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. “Teach Yourself Sanskrit” Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. “India’s Glorious Scientific Tradition” Suresh Soni, Ocean books (P) Ltd., New Delhi.

Course Output

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

AUDIT 1 and 2: VALUE EDUCATION

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Syllabus

Unit	Content	Hours
1	• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism. 0 Moral and non- moral valuation. Standards and principles. 0 Value judgements	4
2	• Importance of cultivation of values. • Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. • Honesty, Humanity. Power of faith, National Unity. • Patriotism, Love for nature ,Discipline	6

3	• Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline. • Punctuality, Love and Kindness. • Avoid fault Thinking. • Free from anger, Dignity of labour. • Universal brotherhood and religious tolerance. • True friendship. • Happiness Vs suffering, love for truth. • Aware of self-destructive habits. • Association and Cooperation. • Doing best for saving nature	6
4	• Character and Competence –Holy books vs Blind faith. • Self-management and Good health. • Science of reincarnation. • Equality, Nonviolence, Humility, Role of Women. • All religions and same message. • Mind your Mind, Self-control. • Honesty, Studying effectively	6

Suggested reading

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

Course outcomes

Students will be able to

1. Knowledge of self-development
2. Learn the importance of Human values
3. Developing the overall personality

AUDIT 1 and 2: CONSTITUTION OF INDIA

Course Objectives:

1. Students will be able to:
2. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
3. To address the growth of Indian opinion regarding modern Indian intellectuals' constitutionalrole and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
4. 3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Syllabus		
Units	**Content**	**Hours**
1	• **History of Making of the Indian Constitution:** • History • Drafting Committee, (Composition & Working)	4
2	• **Philosophy of the Indian Constitution:** • Preamble Salient Features	4

3	• **Contours of Constitutional Rights & Duties:** • Fundamental Rights • Right to Equality • Right to Freedom • Right against Exploitation • Right to Freedom of Religion • Cultural and Educational Rights • Right to Constitutional Remedies • Directive Principles of State Policy • Fundamental Duties.	4
4	• **Organs of Governance:** • Parliament • Composition • Qualifications and Disqualifications • Powers and Functions • Executive • President • Governor • Council of Ministers • Judiciary, Appointment and Transfer of Judges, Qualifications • Powers and Functions	4

5	• **Local Administration:** • District's Administration head: Role and Importance, • Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. • Pachayati raj: Introduction, PRI: ZilaPachayat. • Elected officials and their roles, CEO ZilaPachayat: Position and role. • Block level: Organizational Hierarchy (Different departments), • Village level: Role of Elected and Appointed officials, • importance of grass root democracy	4
6	• **Election Commission:** • Election Commission: Role and Functioning. • Chief Election Commissioner and Election Commissioners. • State Election Commission: Role and Functioning. • Institute and Bodies for the welfare of SC/ST/OBC and women.	4

Suggested reading

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

Course Outcomes:

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.

2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.

4. Discuss the passage of the Hindu Code Bill of 1956.

AUDIT 1 and 2: PEDAGOGY STUDIES

Course Objectives: Students will be able to: 1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers. 2. Identify critical evidence gaps to guide the development.		
Syllabus		
Units	**Content**	**Hours**
1	0 **Introduction and Methodology:** 0 Aims and rationale, Policy background, Conceptual framework and terminology 0 Theories of learning, Curriculum, Teacher education. 0 Conceptual framework, Research questions. 0 Overview of methodology and Searching.	4
2	0 Thematic overview: • Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. • Curriculum, Teacher education.	2

3	• Evidence on the effectiveness of pedagogical practices • Methodology for the in depth stage: quality assessment of included studies. • How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? • Theory of change. • Strength and nature of the body of evidence for effective pedagogical practices. • Pedagogic theory and pedagogical approaches. • Teachers' attitudes and beliefs and Pedagogic strategies.	4
4	• Professional development: alignment with classroom practices and follow- up support • Peer support • Support from the head teacher and the community. • Curriculum and assessment • Barriers to learning: limited resources and large class sizes	4

5	• **Research gaps and future directions**
	  • Research design
	  • Contexts
	  • Pedagogy
	  • Teacher education
	  • Curriculum and assessment
	  • Dissemination and research impact.
		2

Suggested reading

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.

2. Agrawal M (2004) curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.

3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.

4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.

5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

Course Objectives

1. To achieve overall health of body and mind

2. To overcome stress

Syllabus

Unit	*Content*	*Hours*
1	• Definitions of Eight parts of yog. (Ashtanga)	8
2	Yam and Niyam. Do`s and Don't's in life. i) Ahinsa, satya, astheya, bramhacharya and aparigraha ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan	8
3	• Asan and Pranayam i) Various yog poses and their benefits for mind & body ii)Regularization of breathing techniques and its effects-Types of pranayam	8

Suggested Reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

Course Outcomes:

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Objectives

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

Syllabus

Unit	Content	Hours
1	Neetisatakam-Holistic development of personality • Verses- 19,20,21,22 (wisdom) • Verses- 29,31,32 (pride & heroism) • Verses- 26,28,63,65 (virtue) • Verses- 52,53,59 (dont's) • Verses- 71,73,75,78 (do's)	8
2	• Approach to day to day work and duties. • Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48, • Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35, • Chapter 18-Verses 45, 46, 48.	8
3	• Statements of basic knowledge. • Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68 • Chapter 12 -Verses 13, 14, 15, 16,17, 18 • Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42, • Chapter 4-Verses 18, 38,39	8

Suggested reading

1. "Srimad Bhagavad Gita" by Swami SwarupanandaAdvaita Ashram (Publication Department), Kolkata

2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

Course Outcomes

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students.

LIST of EXPERIMENTS for LABORATORIES of M.TECH- CSE, 2018 onwards

By

Board of Study- CSE; on 27th April 2018

Department of Academics

IK Gujral Punjab Technical University

IK Gujral Punjab Technical University

M. Tech; Computer Science Engineering

COURSE CODE: MTCS103-18
COURSE NAME: LAB. ON ADVANCED DATA STRUCTURES
CREDITS: 02, HOURS: 04

Programs may be implemented using C/C++/java

EXP 1:WAP to store k keys into an array of size n at the location computed using a hash function, loc = key % n, where k<=n and k takes values from [1 to m], m>n. To handle the collisions use the following collision resolution techniques,

a. Linear probing
b. Quadratic probing
c. Double hashing/rehashing
d. Chaining

EXP 2: WAP for Binary Search Tree to implement following operations:

a. Insertion
b. Deletion i. Delete node with only child ii. Delete node with both children
c. Finding an element
d. Finding Min element
e. Finding Max element
f. Left child of the given node
g. Right child of the given node
h. Finding the number of nodes, leaves nodes, full nodes, ancestors, descendants.

EXP 3: WAP for AVL Tree to implement following operations: (For nodes as integers)

a. Insertion: Test program for all cases (LL, RR, RL, LR rotation)
b. Deletion: Test Program for all cases (R0, R1, R-1, L0, L1, L-1)
c. Display: using set notation.

EXP 4: WAP to implement Red-Black trees with insertion and deletion operation for the given input data as Integers/Strings

EXP 5:WAP to implement insertion, deletion, display and search operation in m-way B tree (i.e. a non-leaf node can have at most m children) for the given data as integers.

EXP 6:WAP to perform string matching using Knuth-Morris-Pratt algorithm.

EXP 7: WAP to perform string matching using Boyer-Moore algorithm.

EXP 8:WAP to implement 2-D range search over computational geometry problem

EXP 9:WAP on latest efficient algorithms on trees for solving contemporary problems.

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: MTCS104-18

COURSE NAME: LABORATORY. 2 (BASED ON ELECTIVE I and II)

CREDITS: 02, (Elective I + Elective II)

HOURS: 2 hours for Lab based on ElectiveI & 2 hours for Lab based on Elective II

IK Gujral Punjab Technical University

M. Tech; Computer Science Engineering

ELECTIVE – I

MACHINE LEARNING LAB: Programs may be implemented using WEKA/R/PYTHON etc. similar sofftwares

Expt. 1:Study of platform for Implementation of Assignments

Download the open source software of your interest. Document the distinct features and functionality of the software platform. You may choose WEKA, R or any other software.

Expt. 2:Supervised Learning – Regression

Generate a proper 2-D data set of N points.
Split the data set into Training Data set and Test Data set.

i) Perform linear regression analysis with Least Squares Method.
ii) Plot the graphs for Training MSE and Test MSE and comment on Curve Fitting and Generalization Error.
iii) Verify the Effect of Data Set Size and Bias-Variance Trade off.
iv) Apply Cross Validation and plot the graphs for errors.
v) Apply Subset Selection Method and plot the graphs for errors.

Describe your findings in each case.

Expt. 3:Supervised Learning – Classification

Implement Naïve Bayes Classifier and K-Nearest Neighbour Classifier on Data set of your choice. Test and Compare for Accuracy and Precision.

Expt. 4: Unsupervised Learning

Implement K-Means Clustering and Hierarchical clustering on proper data set of your choice. Compare their Convergence.

Expt. 5:Dimensionality Reduction

Principal Component Analysis-Finding Principal Components, Variance and Standard Deviation calculations of principal components.

Expt. 6: Supervised Learning and Kernel Methods

Design, Implement SVM for classification with proper data set of your choice. Comment on Design and Implementation for Linearly non-separable Dataset.

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**.**

WIRELESS SENSOR NETWORKS LAB:Programs may be implemented using NS2/NS3

Expt. 1: Introduction to Network Simulators used for Wireless Sensor Networks.

Expt. 2: Introduction to TCL scripting: Demonstration of one small network simulator setup.

Expt. 3: To study various trace files formats of Network Simulators.

Expt. 4: To create a sensor network setup using the nodes configured with fixed initial energy, transmission power, reception power, routing agent, transport agent and application in rectangular area.

Expt. 5: Create different simulation scenarios by varying MAC protocols.

Expt. 6: Compute the performance of above created simulation scenarios of network in terms of total energy consumption, transmission latency, number of packets generated, received and dropped.

Expt. 7: To implement and compare various routing protocols using above mentioned performance metrics.

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.

INTRODUCTION TO INTELLIGENT SYSTEMS LAB: Programs may be implemented using Matlab/Python

Expt. 1: Implementation of simple artificial neural network.

Expt. 2: Implementation of neural network with backpropagation.

Expt. 3: Implementation of radial basis function network.

Expt. 4: Implementation of recurrent neural network.

Expt. 5: Implementation of fuzzy neural network.

Expt. 6: Implementation of iterative deepening search.

Expt. 7: Implementation of Hill climbing Search algorithm.

Expt. 8: Implementation of optimization genetic algorithm.

Expt. 9: Implementation of induction based learning method such as decision tree.

Expt. 10: Implementation of statistical learning methods such as naive Bayes.

Mini Project: Student has to do a project assigned from course contents in a group of two or three students. The group of students must submit a project report of 8 to 10 pages (approximately) and the team will have to demonstrate as well as have to give a presentation of the same.

ELECTIVE – II

DATA SCIENCE: Programs may be implemented using Matlab/Python/R

IK Gujral Punjab Technical University

M. Tech; Computer Science Engineering

This Cycle introduces you to the use of the R statistical package within the Data Science and Big Data Analytics environment. After completing the tasks in this cycle you shouldableto:

a. Read data sets into R,savethem, and examine thecontents.

Tasks you will complete in this Cycle include:

a. Invoke the R environment and examine the R workspace.
b. Created table and datasets in R.
c. Examine, manipulate and save datasets.
d. Exit the R environment.

Expt. 2: Basic Statistics and Visualization

This Cycle introduces you to the analysis of data using the R statistical package within the Data Science and Big Data Analytics environment. After completing thetasks in Tins Cycle you should able to:

a. Perform summary (descriptive) statistics on the datasets.
b. Create basic visualizations using Rboth to support investigation of the data as well as exploration ofthedata.
c. Create plot visualizations of thedata using a graphics package.

Tasks you will complete in this Cycle include:

a. ReloaddatasetsintotheRstatisticalpackage.
b. Perform summary statistics onthedata.
c. Remove outliersfromthedata.
d. PlotthedatausingR.
e. Plotthedatausinglatticeandggplot.

Expt. 3: K-means Clustering

This Cycle is designed to investigate and practice K-means Clustering. After completing the tasks in This Cycle you should able to:

a. Use R functions to createK-means Clustering models.
b. Use ODBC connection to the database and execute SQL statements and load datasets from the database in an R environment.
c. Visualize the effectiveness of theK-means Clustering algorithm using graphic capabilitiesin R.
d. Use the ODBC connection in the R environment to create the average household income from the census database as test data for K-means Clustering.
e. Use R graphics functions to visualize the effectiveness of theK-means Clustering algorithm.

Expt. 4: Association Rules

This Cycle is designed to investigate and practice Association Rules. After completing tha tasks in This Cycle you should able to:

a. Use R functions forAssociation Rule based models.

Tasks you will complete in this Cycle include:

a. UsetheR-Studioenvironment tocodeAssociationRulemodels.

b. Applyconstraints in the Market Basket Analysismethods such asminimum thresholds onsupport and confidence measures that canbeused toselectinterestingrules fromthesetof allpossible rules.
c. Use R graphics "arules" to execute andinspect the modelsandtheeffectof the various thresholds.

Expt. 5: Linear Regression

a. This Cycle is designed to investigate and practice linear regression. After completing tha tasks in This Cycle you should able to:
a. Use R functions for Linear Regression (Ordinary Least Squares - OLS).
b. Predict the dependent variables based on the model.
c. Investigate different statistical parameter tests that measure the effectiveness of the model.

Tasks you will complete inThis Cycle include:

a. Use the R-Studio environment to code OLS models
b. Review the methodology to validate the model and predict thedependent variable for a setof given independent variables
c. Use R graphics functions to visualize the results generated with the mode

Expt. 7: Naïve Bayesian Classifier

This Cycle is designed to investigate and practice Navive Bayesian classifier. After completing the tasks in This Cycle you should able to:

a. Use R functions for Naïve Bayesian Classification
b. Apply the requirements for generating appropriate training data
c. Validate the effectiveness of the Naïve Bayesian Classifier with the big data

Tasks you will complete in Tins Cycle include:

a. Use R-Studio environment to code the Naïve Bayesian Classifier
b. Use the ODBC connectionto the"census"database to create a training data set for Naïve Bayesian Classifier from the big data.
c. Use the Naive Bayesian Classifier program andevaluatehow well it predicts the results using the training data and then compare the results with original data.

Expt. 8: Decision Trees

This Cycle is designed to investigate and practice Decision Tree (DT) models covered in the course work. After completing the tasks in This Cycle you should able to:

a. Use R functions forDecision Tree models.
b. Predict the outcome of an attribute base don' the model.

Tasks you wil lcomplete in This Cycle include:

a. Use the R-Studio environment to code Decision Tree Models.
b. BuildaDecision TreeModelbasedondatawhoseschema iscomposedofattributes.
c. Predict the outcome of one attribute based on the model.

IK Gujral Punjab Technical University

M. Tech; Computer Science Engineering

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.

DISTRIBUTED SYSTEMS LAB: 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.

ADVANCED WIRELESS AND MOBILE NETWORKS: Programs may be implemented using NS2/NS3/Omnet++

Expt. 1: Setup & Configuration of Wireless Access Point (AP)

Expt. 2: Study of WLAN: Ad Hoc & Infrastructure Mode

Expt. 3: Study of Bluetooth Protocol and Applications
Expt. 4:GSM modem study and SMS client-server application

Expt. 5: Mobile Internet and WML

Expt. 6:J2ME Program for Mobile Node Discovery

Expt. 7: Mobile protocol study using omnet++

Expt. 8: Wireless Network Security: kismet and Netstumbler

Expt. 9: Design and Program Income Tax and Loan EMI Calculator for Mobile Phones

Mini Project: Implementation of Mobile Network using Network Simulator (NS2/NS3)

COURSE CODE: MTCS203-18
COURSE NAME: LABORATORY 3; LAB. ON ADVANCED ALGORITHMS AND SOFT COMPUTING
CREDITS: 02, HOURS: 04 per week

ADVANCED ALGORITHMS: Programs may be implemented using C/C++/java

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Expt. 1: WAP to implement Dijkstra's algorithm for single-source shortest path in a weighted directed graph.
Expt. 2: WAP to find all-pairs shortest path using Floyd-Warshall algorithm.
Expt. 3: WAP to find inverse of a triangular matrix using divide and conquer strategy.
Expt. 4: WAP to convert base (decimal/hexa) representation to modulo representation.
Expt. 5: WAP to implement FFT.

SOFT COMPUTING: Programs may be implemented using Matlab/Python

Expt. 1: WAP to implement array operations in Python
Expt. 2: WAP to append strings using functions in Python
Expt. 3: Study of Neural Network Tool Box/ use of Library functions
Expt. 4: Study of Fuzzy Logic Tool Box/ use of Library functions
Expt. 5: WAP to perform opeartions on fuzzy sets.

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: MTCS204-18

COURSE NAME: LABORATORY 4 ; (BASED ON ELECTIVES)

CREDITS: 02, (Elective III + Elective IV)

HOURS: 2 hours for Lab based on Elective III & 2 hours for Lab based on Elective IV

ELECTIVE – III

DATA PREPARATION AND ANALYSIS LABORATORY: Programs to be implemented using WEKA.

Expt. 1: Using weka tool to explore the data.
Expt. 2: Using weka tool to do Parametric–Means.
Expt. 3: Using weka tool to do Parametric -T-Test.
Expt. 4: Using weka tool to do Correlation analysis
Expt. 5: Preprocess the given data using weka tool.
Expt. 6: Apply different classification techniques to classify the given data set.
Expt. 7: Apply various clusteringtechniques to clusterthe data.
Expt. 8: Apply various association rule mining algorithms.
Expt. 9: Implement classification using Decision tree.
Expt. 10: Apply Visualizationmethods using weka tool.

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.

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1. Write a program to implement authentication to prevent various attacks.
2. Write a program to Limit or increasingly delay failed login attempts.
3. Create a scenario to test authentication of various security attacks.
4. Write a program to debug backdrop entry of given source code.
5. Write a program to debug HTTP headers, input fields, hidden fields, drop down lists, and other web components.
6. Write a program to test Input filtering via white list validation
7. Create a scenario to Set Up Your Own Private Cloud Storage.
8. Setup and configuration Various network services (DNS/ DHCP/ Terminal Services/ Clustering/ Web/ Email)
9. Design and build a database using an enterprise database system
10. Design and implement a directory-based server infrastructure in a heterogeneous systems environment.
11. An attacker wishing to execute SQL injection manipulates a standard SQL query to exploit non-validated input vulnerabilities in a database. Show different ways that this attack vector can be executed.
12. Install IBM Rhapsody Tool using NetBeans for Java and Junit (a unit testing tool).
13. Create a Unified Modelling Language (UML) Class diagram and a UML Sequence diagram using IBM's Rhapsody modelling tool.
14. Configure NetBeans to use JUnit and test code written for the classes and methods described in the UML. .

COMPUTER VISION LABORATORY: 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.

IK Gujral Punjab Technical University

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ELECTIVE – IV

Human and Computer Interaction Lab: Programs may be implemented usingC., C++,Python

Expt. 1: To understand the trouble of interacting with computers - Redesign interfaces of home appliances.

Expt. 2: Design a system based on user-centered approach.

Expt.3: Understand the principles of good screen design.

Expt.4: Redesign existing Graphical User Interface with screen complexity

Expt.5: Implementation of Different Kinds of Menus

Expt. 6: Implementation of Different Kinds of Windows

Expt. 7: Design a system with proper guidelines for icons

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.

GPU COMPUTING LABORATORY: Programs may be implemented using C.

Expt. 1: Setting up Cuda environment.

Expt. 2: Program for parallel matrix multiplication with Cuda.

Expt. 3: Program to demonstrate grids, blocks and threads.

Expt. 4: Program for parallel radix sort.

Expt. 5: Demonstrate parallel reduction with Cuda.

Expt. 6: Program to demonstrate parallel programming for merging two lists.

Expt. 7: Program to demonstrate concept of global memory.

Expt. 8: Program to demonstrate concept of multi-GPUs.

Expt. 9: Program to demonstrate concept of profiling with parallel Nsight.

Expt. 10: Implementation of deep networks for image classification with GPU programming.

DIGITAL FORENSICS:Programs may be implemented usingtools mentioned below:

1. **SysInternals Suite**
   Microsoft System utilities for diagnosis of Windows systems

2. **SANS SIFT**
   SANS Investigate Forensic Toolkit (SIFT)
3. **Wireshark**
   Network protocol analyzer
4. **Trinity Rescue Kit**
   A Linux based recovery and repair toolkit for Windows computers.
5. **Kali Linux**
   A Pen Test toolkit based on Linux. This should only be used to check your own equipment or equipment you have been asked to test.

Expt. 1: To Develop multifaceted cyber-crime scenario (cyber-crime and cyber-terrorism)

- 0 Build a top-down systematic process
- 0 Structure the team and players
- 0 Use an integrated Framework (SI-FI)
- 0 Integrate GOTS, COTS, and R&D Tools
- 0 Use real investigators / compliment with technology experts
- 0 Carefully collect all data, decisions actions during experiment
- 0 Develop metrics for evaluation that match scenario
- 0 Quantify results

Expt. 2: To perform packet-level analysis using appropriate tools (e.g., Wireshark, tcpdump).

Expt. 3: To identify and extract data of forensic interest in diverse media (i.e., media forensics).

Expt. 4: To identify, modify, and manipulate applicable system components within Windows, UNIX, or Linux (e.g., passwords, user accounts, files).

Expt. 5: To collect, process, package, transport, and store electronic evidence to avoid alteration, loss, physical damage, or destruction of data.

Expt. 6: To set up a forensic workstation.

Expt. 7: To use forensic tool suites (e.g., EnCase, Sleuthkit, FTK).

Expt. 8: To use virtual machines. (e.g., Microsoft Hyper-V, VMWare vSphere, Citrix XenDesktop/Server, Amazon Elastic Compute Cloud, etc.).

Expt. 9: To conduct forensic analyses in multiple operating system environments (e.g., mobile device systems).

Expt. 10: To analyze captured malicious code (e.g., malware forensics).

Expt. 11: To use binary analysis tools (e.g., Hexedit, command code xxd, hexdump).

Expt. 12: To implement one-way hash functions (e.g., Secure Hash Algorithm [SHA], Message Digest Algorithm [MD5]).

Expt. 13: To analyze anomalous code as malicious or benign.

Expt. 14: To identify obfuscation techniques.

Expt. 15: To interpret results of debugger to ascertain tactics, techniques, and procedures.

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

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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.

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**

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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**

I. K. Gujral Punjab Technical University
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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.

I. K. Gujral Punjab Technical University
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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).**

I. K. Gujral Punjab Technical University
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: 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

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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

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: 1^{st}	**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	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.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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: 1^{st}	**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: 2^{nd}	**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: 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: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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: 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: 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.

3:	Calculate the average marks of the students of your College.
4:	Print measure of Central Tendency using grouped and ungrouped data.
5:	Construct & print frequency distribution using data with the following Techniques: a) Histogram b) Frequency Polygon c) Frequency Curve c) Ogive curves.
6:	Find out & display the Median and Mode from the following series by using suitable method: Class: 156-158, 158-160, 160-162, 162-164, 164-166 Frequency: 4, 8, 28, 51, 89
7:	Calculate an appropriate measure of dispersion using grouped and ungrouped data.
8:	Make an array and calculate range of the data.
9:	Represent the placement record of the students of your college.
10:	Calculate & display Letter Grade using spreadsheet.
11:	Represent the following data by suitable graphs, determine therefrom the number of children having IQ (i) Below 105 (ii) Above 124. IQ: 75-84, 85-94, 95-104, 105-114, 115-124, 125-134 No. of Children: 8, 20, 45, 54, 28, 16

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-

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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

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, 2^{nd} 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.

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. $x-x^2/2!+x^3/3!- x^4/4!+\dots x^n/n!$ b. $x-x^3/3!+x^5/5!- x^7/7!+\dots x^n/n!$
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, 2ndEdiiton, 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: 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: 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

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

I. K. Gujral Punjab Technical University
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: 4th	**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: 4^{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:** 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: 4^{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:** 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

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

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

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: 5^{th}	**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.

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: 5^{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: 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

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

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: 5th	**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-

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: 5^{th}	**Contact hours:** 44 hours

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 40	**Duration of end semester exam (ESE): 3**hrs
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	

P**rerequisite**: 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

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: 5th	**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: 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	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: 5^{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: 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: 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: - 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 3rd column and 2nd row, only the 3rd row and only the 4th 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: 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	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: 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	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: 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: -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

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: 6^{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	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

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

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.

I. K. Gujral Punjab Technical University
Bachelor of Computer Applications (BCA)

Course Code: UGCA1913
Course Name: Computer Networks

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: --**
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.

I. K. Gujral Punjab Technical University
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

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.

Study Scheme & Syllabus
of

Bachelor of Technology
Computer Engineering

B. Tech (CoE)

Batch 2019 onwards

By Department of Academics

IK Gujral Punjab Technical University

Bachelor of Technology in Computer Engineering

It is a Graduate (UG) Programme of 4 years duration (8 semesters)

Courses & Examination Scheme:

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTPH104-18	Basic Science Course	Semiconductor Physics	3	1	0	40	60	100	4
BTPH114-18	Basic Science Course	Semiconductor Physics (Lab)	0	0	3	30	20	50	1.5
BTAM104-18	Basic Science Course	Math-1	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 Course	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			**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

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
BTA204-18	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 Course	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.**

Third Semester

Course Code	Course Type	Course Title	Load Allocations			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	1	0	40	60	100	3
BTCS 302-18	Professional Core Courses	Object Oriented Programming	3	0	0	40	60	100	3
BTAM304-18	Basic Science Course	Mathematics-III	4	1	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
BTES302-18	Engineering Science Course	Digital Electronics Lab	0	0	2	30	20	50	1
BTCS303-18	Professional Core Courses	Data structure & Algorithms Lab	0	0	4	30	20	50	2
BTCS304-18	Professional Core Courses	Object Oriented Programming lab.	0	0	4	30	20	50	2
BTCS305-18	Professional Core Courses	IT Workshop*	0	0	2	30	20	50	1
		Summer Institutional Training	0	0	0	60	40	100	Satisfactory/Un satisfactory
Total			**15**	**3**	**12**	**380**	**420**	**800**	**21**

*Syllabus to be decided by respective institute internally. It may include latest technologies.

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			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	1	0	40	60	100	3
BTCS 402-18	Professional Core Courses	Operating Systems	3	1	0	40	60	100	3
BTCS 403-18	Professional Core Courses	Design & Analysis of Algorithms	3	1	0	40	60	100	3
HSMC 122-18	Humanities & Social Sciences including Management Courses	Universal Human Values-II	2	1	0	40	60	100	3
EVS101- 18	Mandatory Courses	Environmental Sciences	1	-	-	-	-	-	0
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**	**5**	**10**	**290**	**360**	**650**	**21**

There will be 4-6 weeks summer industrial training after 4th sem.

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**	**460**	**440**	**900**	**23**

* 4-6 weeks industrial training undertaken after 4th semester in summer vacations.

Sixth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
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**

Seventh 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**

Eighth Semester

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
BTCS 801-18	Semester Training	300	200	500	16

LIST OF ELECTIVES

Elective-I

BTCOE 508-18 Microprocessor & Assembly Language Programming
BTCOE 509-18 Computer Peripheral & Interface
BTCOE 510-18 Graph Theory
BTCOE 511-18 Microprocessor & Assembly Language Programming lab
BTCOE 512-18 Computer Peripheral & Interface lab
BTCOE 513-18 Graph Theory Lab
BTCS 510-18 Programming in Python
BTCS 513-18 Programming in Python Lab

LIST OF COURSES FOR HONOURS DEGREE

In order to have an Honours degree, a student choose 18-20 credits from the following courses in addition.

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS H01-18	Professional Elective Courses	Graph Theory	3	0	0	40	60	100	3
BTCS H02-18	Professional Elective Courses	Computer Vision	3	0	0	40	60	100	3
BTCS 611-18	Professional Elective Courses	Embedded Systems	3	0	0	40	60	100	3
BTCS H03-18	Professional Elective Courses	Software Project Management	3	0	0	40	60	100	3
BTCS H04-18	Professional Elective Courses	Cryptography & Network Security	3	0	0	40	60	100	3
BTCS H05-18	Professional Elective Courses	Internet-of-Things	3	0	0	40	60	100	3
BTCS 804-18	Professional Elective Courses	Data Analytics	3	0	0	40	60	100	3
BTCS 608-18	Professional Elective Courses	Machine Learning	3	0	0	40	60	100	3
BTCS H06-18	Professional Elective Courses	ICT in Agriculture and Rural Development	3	0	0	40	60	100	3
BTCS H07-18	Professional Elective Courses	Computational Technologies for Smart Cities	3	0	0	40	60	100	3
BTCS H08-18	Professional Elective Courses	Computer Forensics	3	0	0	40	60	100	3

First Semester

BTPH104-18	**Semiconductor Physics**	**L-3, T-1, P-0**	**Credits - 4**
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.

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	Credits - 1.5
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. 11. http://vlab.amrita.edu/index.php?sub=1

BTAM104-18	Mathematics Paper-I (Calculus & Linear Algebra)	4L, 1T, 0P	credits - 4

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

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.
4. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
5. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.

6. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
8. 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.

BTEE-101-18	**Basic Electrical Engineering**	**[L: 3; T:1; P : 0]**	**credits - 4**

Pre-requisites (if any): Nil

Detailed contents:

Module 1: DC Circuits (8 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 (8 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: Transformers (6 hours)

Magnetic materials, BH characteristics, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three phase transformer connections.

Module 4: Electrical Machines (8 hours)

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 5: Power Converters (6 hours)

DC-DC buck and boost converters, duty ratio control. Single-phase and three-phase voltage source inverters; sinusoidal modulation.

Module 6: Electrical Installations (6 hours)

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, 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

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

Course Outcomes

1. To understand and analyze basic electric and magnetic circuits
2. To study the working principles of electrical machines and power converters.
3. To introduce the components of low voltage electrical installations

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BTEE-102-18	**Basic Electrical Engineering Laboratory**	**[L: 0; T:0; P : 2]**	**1 credit**
Pre-requisites (if any): Nil			

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.
- Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Laboratory Outcomes

I. Get an exposure to common electrical components and their ratings.
II. Make electrical connections by wires of appropriate ratings.
III. Understand the usage of common electrical measuring instruments.
IV. Understand the basic characteristics of transformers and electrical machines.
V. Get an exposure to the working of power electronic converters.

Sr. 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.
11.	To connect measuring analog and digital instruments to measure current, voltage, power and power factor.
12.	To obtain the characteristics of a transistor under common base (CB) and common emitter (CE) configuration.
13.	To perform open- and short circuit tests on a single- phase transformer and calculate its efficiency
14.	To start and reverse the direction of rotation of a (i) DC motor (ii) Induction motor

15.	Determining of voltage regulation of transformer by directly loading.
16.	Study of starters for (i) DC motor (ii) Induction motor

BTME101-18	**Engineering Graphics & Design (Theory & Lab)**	**L:1 T:0 P:4**	**Credits - 3**
Pre-requisites (if any): Nil			

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 nonparametric 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:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, SciTech Publishers
5. (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 to address:

- 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

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)

Second Semester

BTCH101-18	Chemistry-I (Theory)	L:3 T:1 P:0	Credits: 4

Pre-requisites (if any): Nil

Detailed contents

1. 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.

2. 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.

3. 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 H3, H2F and HCN and trajectories on these surfaces.

4. 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.

5. 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

6. 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

7. 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

1. University chemistry, by B. H. Mahan
2. Chemistry: Principles and Applications, by M. J. Sienko and R.A. Plane
3. Fundamentals of Molecular Spectroscopy, by C. N. Banwell
4. Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
5. Physical Chemistry, by P. W. Atkins (
6. 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

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BTCH102-18	**Chemistry-I (Lab.)**	**L:0 T:0 P:3**	**Credits- 1.5**

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

BTA204-18	**Mathematics Paper-II (Probability & Statistics)**	**4L:1T:0P**	**credits - 4**

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.

BTPS101-18	Programming for Problem Solving (Theory)	L:3 T:0 P:0	Credits: 3

Pre-requisites (if any): Nil

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-Hil

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.

BTPS102-18	Programming for Problem Solving (Lab)	L:0 T:0 P:4	Credits: 2

Pre-requisites (if any): Nil

[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.

BTMP101-18	Workshop/Manufacturing Practices (Theory)	L:1 T:0 P:0	Credits:3

Pre-requisites (if any): Nil

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", 4 th 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.

BTMP101-18	Workshop Practice	L : 0; T:0 ; P : 4	credits - 2

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	credits - 2

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

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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

Third Semester

Course Code: BTES 301-18	**Course Title**: Digital Electronics	**3L:0T:0P**	**3 Credits**

Detailed Contents:

Module 1: **NUMBER SYSTEMS:**
Binary, Octal, Decimal, Hexadecimal. Number base conversions, 1's, 2'scomplements, signed Binary numbers. Binary Arithmetic, Binary codes: Weighted BCD, Graycode, Excess 3code, 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, Karnaughmap 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 in to 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 to f shift registers.
3. Study different types of memories and their applications. Convert digital signal into analog and vice versa.

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
3. McGraw Hill Publishing Company Limited, New Delhi, 2003.
4. R.P.Jain, Modern Digital Electronics, 3ed. Tata McGraw–Hill publishing company limited, New Delhi, 2003.
5. Thomas L.Floyd, Digital Fundamentals, Pearson Education, Inc, New Delhi, 2003.
6. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, Digital System – Principles and Applications, Pearson Education
7. Ghosal, Digital Electronics, Cengage Learning.

Course Code: BTCS 301-18	**Course Title:** Data Structure & Algorithms	**3L:1T:0P**	**3Credits**

Module1: 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)

Module2: 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)

Module3: 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)

Module4: 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)

Module4: 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; &
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, Sartaj Sahni, and 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: BTCS 302-18	**Course Title:** Object Oriented Programming	**3L:0T:0P**	**3Credits**

Objectives of the course:

The course will introduce standard tools and techniques for software development, using object oriented approach, use of a version control system, an automated build process, an appropriate framework for automated unit and integration tests.

Detailed Contents:

- Abstract data types and their specification.
- How to implement an ADT. Concrete state space, concrete invariant, abstraction function. Implementing operations, illustrated by the Text example.
- Features of object-oriented programming. Encapsulation, object identity, polymorphism – but not inheritance.
- Inheritance in OO design.
- Design patterns. Introduction and classification. The iterator pattern.
- Model-view-controller pattern.
- Commands as methods and as objects.
- Implementing OO language features.
- Memory management.
- Generic types and collections
- GUIs. Graphical programming with Scala and Swing
- The software development process.

The concepts should be practised using C++ and Java. Pearl may also be introduced wherever possible.

Suggested books

1. Object-Oriented Programming in C++, Robert Lafore, SAMS Publiishing.
2. Object Oriented Programming with C++ by E Balagurusamy
3. C++ How to Program, 10th Edition, Paul J. Deitel, Deitel & Associates, Inc., Harvey Deitel, Harvey M. Deitel

Course Outcomes

After taking the course, students will be able to:

1. Specify simple abstract data types and design implementations, using abstraction functions to document them.
2. Recognise features of object-oriented design such as encapsulation, polymorphism, inheritance, and composition of systems based on object identity.
3. Name and apply some common object-oriented design patterns and give examples of their use.
4. Design applications with an event-driven graphical user interface.

Course Code: BTAM304-18	**Course Title:** Mathematics Paper-III (Calculus and Ordinary Differential Equations)	**4L:1T:0P**	**4Credits**

Detailed Contents:

Module1:

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 (Cartesiantopolar), Applications of double and triple integrals to find surface area and volumes.

[CO1, CO2] (12Hrs)

Module2:

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.)**

Module3:

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'stype.

[CO4] (12hrs.)

Module4:

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] (12hrs.)

Suggested Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th 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, 9th 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, PHI, 1995

Course Outcomes:

At the end of the course, the student will be able to:

1. 1.Understand the functions of several variables that are essential in most branches 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 solve engineering problems related to convergence, infinite series, power series and Taylor series.
4. Create, select and utilize the learnt techniques of first degree ordinary differential equations to model real world problems
5. Be acquainted with the knowledge required to solve higher order ordinary differential equations.

Course Code: HSMC 101-18	**Course Title:** Development of Societies	**2L:1T: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

- Interact with local communities and understand their issues.
- Study local cottage industry and agricultural practices. Role of engineering and specialized knowledge.
- 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	**2L:1T:0P**	**3Credits**

Detailed Contents:

Unit1:

The difference between knowledge (Vidya) and Ignorance (Avidya):

- Upanishads;
- Six systems orthodox and Heterodox Schools of Indian Philosophy.
- Greek Philosophy:

Unit2:

Origin of Universe:

- Nasidiya Sukta:"Who really knows?"
- Brhadaranyaka Upanishad; Chandogya Upanishad: Non-self, Self, real and unreal.
- Taittiriya Upanishad: Siksha Valli.
- 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.

Unit3:
Knowledge as Power: Francis Bacon. Knowledge as both power and self-realization in Bagavad Gita.

Unit4:
Knowledge as oppression: M. Foucault. Discrimination between Rtam and Satyam in Indian Philosophy.

Unit5:
Knowledge as invention: Modern definition of creativity; scientific activity in the claim that Science invents new things at least through technology.

Unit6:
Knowledge about the self, transcendental self; knowledge about society, polity and nature.

Unit7:
Knowledge about moral and ethics codes.

Unit8:
Tools of acquiring knowledge: Tantrayuktis, asystem ofinquiry(Caraka, Sushruta, Kautilya, Vyasa)

READINGS

1. Copleston, Frederick, History of Philosophy, Vol. 1. Great Britain: Continuum.
2. Hiriyanna, M. Outlines of Indian Philosophy, Motilal Banarsidass Publishers; Fifth Reprint edition (2009)
3. Sathaye, Avinash, Translation of Nasadiya Sukta
4. Ralph T. H. Griffith. The Hymns of the Ṛgveda. Motilal Banarsidass: Delhi: 1973.
5. Raju, P. T. Structural Depths of Indian Thought, Albany: State University of New York
6. Press.
7. Plato, Symposium, Hamilton Press.
8. Kautilya Artha Sastra. Penguin Books, New Delhi.
9. Bacon, Nova Orgum
10. Arnold, Edwin. The Song Celestial.
11. Foucault, Knowledge/Power.
12. Wildon, Anthony, System of Structure.
13. Lele, W.K. The Doctrine of Tantrayukti. Varanasi: Chowkamba Series.
14. Dasgupta, S. N. History of Indian Philosophy, Motilal Banasidas, Delhi.
15. 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 Madhyastha Darshan.

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: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 subtract or 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

Course Code: BTCS 303-19	**Course Title:** Data Structure & Algorithms Lab	**0L:0T:4P**	**2Credits**

L<u>ist of Experiment:</u>

Task1: Write a program to insert an element at end as well as at a given position in an array.
Task2: Write a program to delete an element from a given whose value is given or whose position is given.
Task3: Write a program to find the location of a given element using Linear Search.
Task4: 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.
Task9: Write a program to implement insertion and deletion operations in a queue using linear array.
Task10: 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

Task11: 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.
Task14: Program to sort an array of integers in ascending order using bubble sort.
Task15: 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.

Task17: 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.

Course Code: BTCS 304-18	**Course Title:** Object Oriented Programming Lab	**0L:0T:4P**	**2Credits**

List of Experiment:

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.
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

Course Code: BTCS401-18	Course Title: Discrete Mathematics	L:3;T:1; P:0	4Credits

Objectives of the course:

Throughout the course, students will be expected to demonstrate their understanding of Discrete Mathematics by being able to do each of the following:

1. Use mathematically correct terminology and notation.
2. Construct correct direct and indirect proofs.
3. Use division into cases in a proof.
4. Use counterexamples.
5. Apply logical reasoning to solve a variety of problems.

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.

Module 2:

Basic counting techniques-inclusion and exclusion, pigeon-hole principle, permutation and combination.

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.

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

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.

Suggested books:

1. Kenneth H. Rosen, **Discrete Mathematics and its Applications**, Tata McGraw – Hill
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 It's 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. For a given logic sentence express it in terms of predicates, quantifiers, and logical connectives
2. For a given a problem, derive the solution using deductive logic and prove the solution based on logical inference
3. For a given a mathematical problem, classify its algebraic structure
4. Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra
5. Develop the given problem as graph networks and solve with techniques of graph theory.

Course Code: BTES402- 18	**Course Title:** Computer Organization and Architecture	**3L:1T:0P**	**3Credits**

Pre-requisites: Digital Electronics

Detailed Contents:

Module1: 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 of8085 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-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.

[10 hrs] (CO1, CO2)

Module2: 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)

Module3: Pipelining

Basic concepts of pipelining, throughput and speed up, pipeline hazards.

Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.

[10 hrs] (CO5)

Module4: 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 Writing assembly language programs;
3. Design a memory module and analyzeits 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. "Computer Organization and Architecture", Moris Mano,
2. "Computer Organization 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 Carl Hamacher, 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.

CourseCode:BTCS402-19	**Course Title:** Operating Systems	**3L:1T:0P**	**3Credits**

Detailed Contents:

Module1: 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)

Module2: 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)

Module3: Inter-process Communication

Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's Solution, The Producer\Consumer Problem, Semaphores, Event Counters, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

[8 hrs] (CO2)

Module4: Deadlocks

Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

[8 hrs] (CO3)

Module5: Memory Management

Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation –Fixed and variable partition– Internal and 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)

Module6: 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, Allocation methods (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 Avi Silberschatz, 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

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Course Code: BTCS403- 18	**Course Title**: Design and Analysis of Algorithms	**3L:1T:0P**	**3Credits**

Pre-requisites: Data Structures

Detailed Contents:

Module1: Introduction

Characteristics of algorithm. Analysis of algorithm: Asymptotic analysis of complexity bounds– best, average and worst-case behaviour; 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 write the 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. Analysis and Design of Algorithms: A Beginner's Approach Paperback – 1 January 2015 by Rajesh K. Shukla
2. Introduction to Algorithms, 4TH Edition, Thomas H Cormen, Charles ELieserson, Ronald L Rivest and Clifford Stein, MIT Press/McGraw-Hill.
3. Data Structures and Algorithms in C++, Weiss, 4th edition, Pearson.
4. Fundamentals of Computer Algorithms– E. Horowitz, Sartaj Saini, Galgota Publications.

Reference Books

1. Algorithm Design, 1st Edition, Jon Kleinberg and Éva Tardos, 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, Udi Manber, Addison-Wesley, Reading, MA.

Course Code: HSMC122-18	**Course Title:** Universal Human Values 2: Understanding Harmony	**2L:1T:0P**	**3Credits**

COURSE TOPICS:

The course has 28 lectures and 14 practice sessions in 5 modules:

Module1: 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 Experiential Validation- 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.

Module2: 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'-happiness and physical facility
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 Health; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Health.
7. Include practice sessions to discuss the role other shave played in making material goods available tome. Identifying from one's own life. Differentiate between
8. Prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

Module3: Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. 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.
2. Understanding t h e meaning of Trust; Difference between intention and competence
3. Understanding t h e meaning of Respect, Difference between respect and differentiation; the other salient values in relationship.
4. Understanding the harmony in the society (society being an extension of family): Resolution,
   Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
5. 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

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self- regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
4. 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.

Module5: 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.

7. 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: Ek Parichaya, A. Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N.Tripathi, New Age International Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth-by Mohan das Karam chand Gandhi
6. Small is Beautiful-E. F Schumacher.
7. Slow is Beautiful-Cecile Andrews
8. Economy of Permanence- JC Kumarappa
9. Bharat Mein Angreji Raj-Pandit Sunder lal
10. Re discovering India –by Dharampal
11. Hind Swarajor Indian Home Rule-by Mohan das K. Gandhi
12. India Wins Freedom- Maulana Abdul Kalam Azad
13. Vivekananda-Romain Rolland (English)
14. 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	**1L:0T:0P**	**0Credits**

COURSE TOPICS:

Detailed Contents:

Module1: 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 groundwater, 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, waterlogging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and nonrenewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Landas are source, land degradation, man induced landslides, soil erosion and desertification.

- Role of an individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Module2: Ecosystems

Concept of an ecosystem. Structure and function of an ecosystem. Foodchains, foodwebs 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)

Module3: 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-wild life conflicts.
- Endangered and endemic species of India

Module4: 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.

<u>Case Studies.</u>

- Public awareness.

***ACTIVITIES**

Nature club (birdwatching, 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 have been courage 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

a) To live with some eminent environment a list for a week or so to understand his work
b) To work in kitchen garden for mess
c) To know about the different varieties of plants
d) Shutting down the fans and ACs of the campus for an hour or so
e) Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wetlands
f) Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural n) Visit to a Wild life sanctuary, 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, Map in Publishing Pvt. Ltd.,Ahmedabad – 380013, India, Email: mapin@icenet.net(R)
3. BrunnerR.C., 1989, Hazardous Waste Incineration, McGrawHillInc.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.Press1140p.
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 Standards, 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.

Course Code: BTCS402-18	**Course Title:** Computer Organization & Architecture Lab	**0L:0T:2P**	**1Credits**

List of Experiment:

Task 1: Computer Anatomy- Memory, Ports, Mother board and add-on cards.
Task 2: Dismantling and assembling PC.
Task 3: Introduction to 8085 kit.
Task 4: 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 often 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'scomplement 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 Microcontrollers by B. Ram, Dhanpat Rai.

Course Code: BTCS 404-18	**Course Title:** Operating Systems Lab	**0L:0T:4P**	**2Credits**

List of Experiment:

Task1: 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.

Task6: 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.Woodhulland Andrew S. Tanenbaum, Pearson Education.

Course Code: BTCS 405- 18	Course Title: Design and Analysis of Algorithms Lab	0L:0T:4P	2Credit

List of Experiment:

Task1: Code and analyze solutions to following problem with given strategies:

i. Knap Sack using greedy approach
ii. Knap Sack using dynamic approach

Task2: Code and analyze to find an optimal solution to matrix chain multiplication using dynamic programming.

Task3: Code and analyze to find an optimal solution to TSP using dynamic programming.

Task4: 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 amaze.

Task5: 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.

Task6: Code and analyze to find shortest paths in a graph with positive edge weights using Dijkstra’s algorithm.

Task7: Code and analyze to find shortest paths in a graph with arbitrary edge weights using Bellman- Ford algorithm.

Task8: Code and analyze to find shortest paths in a graph with arbitrary edge weights using Flyods’ algorithm.

Task9: Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Prims’ algorithm

Task10: Code and analyze to find the minimum spanning tree in a weighted, undirected graph using Kruskals’ algorithm.

Task11: 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, 4thedition, Pearson
2. Data Structures and Algorithms using Python and C++, David M. Reed and John Zelle, 2009 edition (available as ebook), Franklin Beedle & Associates.

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)

Course Outcomes:

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:

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**

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)

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**

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:
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**

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.

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: BTCOE 508-18	**Course Title:** Microprocessor & Assembly Language Programming	**3L:0T:0P**	**3 Credits**

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

Detailed Contents:

Module 1:
Introduction: Introduction to Microprocessors, history, classification, recent microprocessors. [5]

Module 2:
Microprocessor Architecture: 8085 microprocessor Architecture. Bus structure, I/O, Memory & System buses, concept of address Bus, Data Bus & Control Bus, Synchronous & Asynchronous buses. Instruction execution sequence & Data Flow, Instruction cycle. [5]

Module 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]

Module 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]

Module 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]

Module 6:
Basic architecture of higher order microprocessors: Basic introduction to 8086 family, motorola 68000, Pentium processors.

Text Books:

1. 8085 Microprocessor by Ramesh Gaonkar, 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

Course Code: BTCOE 511-18	Course Title: Microprocessor & Assembly Language Programming Lab	0L:0T:2P	1 Credits

List of Experiments:

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.

References: Microprocessor by B. Ram, Dhanpat Rai Publications.

Course Code: BTCOE509-	Course Title: Computer Peripherals and Interfaces	3L:0T:0P	3 Credits

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

Detailed Contents:

Module 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.

Module 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.

Module 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.

Module 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 and parallel port, USB Mouse/ Keyboard Interfaces.

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

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

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

Text 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.

Course Code: BTCOE512-18	**Course Title:** Computer Peripherals and Interfaces Lab	**0L:0T:2P**	**1 Credits**

List of Experiments:

1. To study the construction and working of CRT, LCD, LED (coloured and black and white monitor) and its troubleshooting .
2. To Study the components and internal parts, working of hard disk and CDROM, DVD, Flash Drives
3. To study the operations and components and internal parts of Key Board, mouse and their troubleshooting
4. Study of components and internal parts and working of DMP, Inkjet printer and Laser printer and various installation of printers
5. To study the SMPS circuit and measure its various voltages. Connecting SMPS to motherboard and other devices.
6. Study the operation and maintenance of UPS.
7. Exercise on assembling a PC with peripherals and testing the same.
8. Setup and configuration of ROM BIOS
9. Visit to nearby industry

Course Code: BTCOE 510-18	**Course Title:** Graph Theory	**3L:0T:0P**	**3 Credits**

Detailed Contents:

Unit-1
Introduction to Graph Theory **7 hours**
Definitions and Examples, Subgraphs, Complements, and Graph Isomorphism, Vertex Degree, Euler Trails and Circuits

Unit-2
Introduction to Graph Theory contd **6 hours**
Planar Graphs, Hamilton Paths and Cycles, Graph Colouring, and Chromatic Polynomials

Unit-3
Trees **6 hours**
Definitions, Properties, and Examples, Routed Trees, Trees and Sorting, Weighted Trees and Prefix Codes

Unit-4
Optimization and Matching **7 hours**
Dijkstra's Shortest Path Algorithm, Minimal Spanning Trees – The algorithms of Kruskal and Prim, Transport Networks – Max-flow, Min-cut Theorem, Matching Theory

Unit-5
Fundamental Principles of Counting **6 hours**
The Rules of Sum and Product, Permutations, Combinations – The Binomial Theorem, Combinations with Repetition, The Catalon Numbers
Unit-6
The Principle of Inclusion and Exclusion **6 hours**
The Principle of Inclusion and Exclusion, Generalizations of the Principle, Derangements – Nothing is in its Right Place, Rook Polynomials
Unit-7
Generating Functions **7 hours**
Introductory Examples, Definition and Examples – Calculational Techniques, Partitions of Integers, the Exponential Generating Function, the Summation Operator
Unit-8
Recurrence Relations **7 hours**
First Order Linear Recurrence Relation, The Second Order Linear Homogeneous Recurrence Relation with Constant Coefficients, The Non-homogeneous Recurrence Relation, The Method of Generating Functions

Course Code: BTCOE 513-18	**Course Title:** Graph Theory Lab	**0L:0T:4P**	**2 Credits**

List of Experiments:

The tasks can be assigned as per the instructor.

Course Code: BTCS 510-18	**Course Title: Programming in Python**	**3L:0T:0P**	**3 Credits**

Detailed Syllabus:

UNIT - I 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

CO 1,2

UNIT - II 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

CO 2,3

UNIT - III 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

CO 3,4

UNIT - IV 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

CO 4,5

UNIT – V Database Programming: Introduction, Python Database Application Programmer’s Interface (DB-API), Object Relational Managers (ORMs), Related

Modules

CO 5

Course Outcomes:

At the end of the course the student should be able to:
CO 1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.
CO 2: Demonstrate proficiency in handling Strings and File Systems.
CO 3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.
CO 4: Interpret the concepts of Object-Oriented Programming as used in Python.
CO 5: Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Suggested Readings/Books

1. Textbook 1**. Core Python Programming**, Wesley J. Chun, Second Edition, Pearson.

Course Code: BTCS 513-18	Course Title: Programming in Python Lab	0L:0T:2P	1Credi

Detailed List of Tasks:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python. 3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
3. Write a python script to print the current date in the following format "Sun May 29 02:26:23 IST 2017"
4. Write a program to create, append, and remove lists in python.
5. Write a program to demonstrate working with tuples in python.
6. Write a program to demonstrate working with dictionaries in python.
7. Write a python program to find largest of three numbers.
8. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]

9. Write a Python program to construct the following pattern, using a nested for loop

```
 *
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

10. Write a Python script that prints prime numbers less than 20.
11. Write a python program to find factorial of a number using Recursion.
12. 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).
13. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
14. Write a python program to define a module and import a specific function in that module to another program.
15. 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.
16. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
17. Write a Python class to convert an integer to a roman numeral.
18. Write a Python class to implement pow(x, n)
19. Write a Python class to reverse a string word by word.

Scheme & Syllabus of

Master of Computer Applications

(MCA)

Batch 2020 onwards

By

Board of Study Computer Applications

Department of Academics

IK GujralPunjab Technical University

MCA Eligibility

THE GENERAL ELIGIBILITY CRITERIA FOR MCA 2 YEARS (FOUR SEMESTERS):

MCA ELIGIBILITY:

Passed BCA/B.Sc(CS/IT)/B.Voc with Computer as a major subject/Bachelor's Degree in CSE/IT or equivalent degree of minimum three years duration.

Or

Passed B.Sc./ B.Com./ B.A. with Mathematics at l0+2 Level or at Graduation Level (With additional bridge course as per norms of IKG PTU Jalandhar)/ Bridge course will be exempted if the candidate apart from above qualification has passed PGDCA or minimum One Year Diploma in Computer Application/Science/IT or equivalent from any recognized University/Institution.

Note: The candidate must have obtained at least 50% marks (45% marks in case of candidates belonging to reserved category) in the qualifying Examination.

PROGRAM OUTCOMES (POs)

Computational Knowledge: Apply knowledge of computing fundamentals, computing specialization, mathematics, and domain knowledge appropriate for the computing specialization to the abstraction and conceptualization of computing models from defined problems and requirements.

Problem Analysis: Identify, formulate, research literature, and solve complex computing problem searching substantiated conclusions using fundamental principles of mathematics, computing sciences, and relevant domain disciplines.

Design /Development of Solutions: Design and evaluate solutions for complex computing problems, and design and evaluate systems, components, or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

Conduct investigations of complex Computing problems: User search-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Modern Tool Usage: Create, select, adapt and apply appropriate techniques, resources, and modern computing tools to complex computing activities, with an understanding of the limitations.

Professional Ethics: Understand and commit to professional ethics and cyber regulations, responsibilities, and norms of professional computing practices.

Life-long Learning: Recognize the need, and have the ability, to engage in independent learning for continual development as a computing professional.

Project management and finance: Demonstrate knowledge and understanding of the computing and management principles and apply these to one's own work, as a member and leader in a team to manage projects and in multidisciplinary environments.

Communication Efficacy: Communicate effectively with the computing community, and with society at large, about complexcomputingactivitiesbybeingabletocomprehendandwriteeffectivereports, design documentation, make effective presentations, and give and understand clear instructions.

Societal and Environmental Concern: Understand and assess societal, environmental, health, safety, legal, and cultural issues within local and global contexts, and the consequential responsibilities relevant to professional computing practices.

Individual and Team Work: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary environments.

Innovation and Entrepreneurship: Identify a timely opportunity and using innovation to pursue that opportunity to create value and wealth for the betterment ofthe individual and society at large.

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA-B1	Bridge Course*	Computer Programming using C	2	0	0	50	-	50	S/US
PGCA-B2	Bridge Course*	Computer Science Essentials	2	0	0	50	-	50	S/US
PGCA1917	Core Theory	Discrete Structures & Optimization	4	0	0	30	70	100	4
PGCA1951	Core Theory	Programming in Python	4	0	0	30	70	100	4
PGCA1952	Core Theory	Advanced Data Structures	4	0	0	30	70	100	4
PGCA1953	Core Theory	Advanced Database Management System	4	0	0	30	70	100	4
PGCA1905	Ability Enhancement Compulsory Course (AECC)	Technical Communication	3	0	0	30	70	100	3
PGCA1954	Core Practical/Laboratory	Data Structures using Python Laboratory	0	0	4	70	30	100	2
PGCA1955	Core Practical/Laboratory	Advanced Database Management System Laboratory	0	0	4	70	30	100	2
PGCA1908	Ability Enhancement Compulsory Course (AECC)	Technical Communication Laboratory	0	0	2	30	20	50	1
	TOTAL		**19**	**0**	**10**	**320**	**430**	**750**	**24**

***Bridge courses are not applicable to all the students, please refer MCA eligibility given above in order to offer bridge courses to students.**

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1909	Core Theory	Web Technologies	4	0	0	30	70	100	4
PGCA1920	Core Theory	Design & Analysis of Algorithms	4	0	0	30	70	100	4
PGCA1918	Core Theory	Advanced Java	4	0	0	30	70	100	4
PGCA1956	Core Theory	Linux Administration	4	0	0	30	70	100	4
PGCA1932	Core Theory	Information Security & Cyber Law	4	0	0	30	70	100	4
PGCA1914	Core Practical/Laboratory	Web Technologies Laboratory	0	0	4	70	30	100	2
PGCA1922	Core Practical/Laboratory	Advanced Java Laboratory	0	0	4	70	30	100	2
PGCA1957	Core Practical/Laboratory	Linux Administration Laboratory	0	0	4	70	30	100	2
	TOTAL		**20**	**0**	**12**	**360**	**440**	**800**	**26**
Students will undergo 4 weeks Summer Training after 2nd semester. Examination will be conducted along with 3rd semester practical.									

Third Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1925	Core Theory	Advanced Computer Networking	4	0	0	30	70	100	4
PGCA1926	Core Theory	Artificial Intelligence & Soft Computing	4	0	0	30	70	100	4
PGCA1927	Core Theory	Theory of Computation	4	0	0	30	70	100	4
	Elective – I		4	0	0	30	70	100	4
	Elective – II		4	0	0	30	70	100	4
PGCA1928	Core Practical/ Laboratory	Advanced Computer Networking Laboratory	0	0	4	70	30	100	2
PGCA1929	Core Practical/ Laboratory	Artificial Intelligence & Soft Computing Laboratory	0	0	4	70	30	100	2
	Elective – II Laboratory		0	0	4	70	30	100	2
PGCA1969		**Summer/Institutional Training	0	0	4	70	30	100	2
	TOTAL		**20**	**0**	**16**	**430**	**470**	**900**	**28**

Elective – I	
Course Code	**Course Title**
PGCA1930	Software Project Management
PGCA1971	Optimization Techniques
PGCA1972	Data Mining and Business Intelligence
PGCA1973	Enterprise Resource Planning

Elective – II	
Course Code	**Course Title**
PGCA1933	Mobile Applications Development
PGCA1935	Simulation & Modelling
PGCA1921	e-Commerce and Digital Marketing
PGCA1931	Software Testing & Quality Assurance

Elective – II Laboratory	
Course Code	**Course Title**
PGCA1934	Mobile Applications Development Laboratory
PGCA1936	Simulation & Modelling Laboratory
PGCA1974	e-Commerce and Digital Marketing Laboratory
PGCA1975	Software Testing & Quality Assurance Laboratory

Fourth Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
PGCA1976	Core Theory	Machine Learning & Data Analytics using Python	4	0	0	30	70	100	4
PGCA1958	Core Theory	Advanced Web Technologies	4	0	0	30	70	100	4
PGCA1977	Core Practical/ Laboratory	Machine Learning & Data Analytics using Python Laboratory	0	0	4	70	30	100	2
PGCA1960	Core Practical/ Laboratory	Advanced Web Technologies Laboratory	0	0	4	70	30	100	2
	Elective – III		4	0	0	30	70	100	4
	Elective – III Laboratory		0	0	4	70	30	100	2
PGCA1961		Research/Technical Seminar	0	0	2	0	100	100	1
PGCA1962		Project	0	0	8	180	120	300	4
	TOTAL		**12**	**0**	**22**	**480**	**520**	**1000**	**23**

Elective – III	
Course Code	**Course Title**
PGCA1937	Cloud Computing
PGCA1963	Digital Image Processing
PGCA1965	NLP and Speech Recognition
PGCA1967	IOT &Blockchain Technology

Elective – III Laboratory	
Course Code	**Course Title**
PGCA1938	Cloud Computing Laboratory
PGCA1964	Digital Image Processing Laboratory
PGCA1966	NLP and Speech Recognition Laboratory
PGCA1968	IOT &Blockchain Technology Laboratory

Course Code: PGCA-B1
Course Name: Computer Programming using C

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1^{st}	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE): -**
Total marks: 50	**Elective status:** No

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.	6
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.	8
Unit-III **Arrays**: Defining, processing arrays, passing arrays to a function, multi–dimensional arrays.	8

Strings: String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables. **Functions**: Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion. **Objects and Classes:** Introduction to Object Oriented Concepts, Features of OOP, Basic of classes and Objects.	

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: PGCA-B2
Course Name: Computer Science Essentials

Program: MCA (Bridge Course)	**L**: 2 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 2
Semester: 1^{st}	**Contact hours:** 22 hours
Internal max. marks: 50	**Theory/Practical:** Theory
External max. marks: -	**Duration of end semester exam (ESE): -**
Total marks: 50	**Elective status:** No

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 basic concepts of Operating Systems and Database Systems
CO4	Learn basic word processing, Spreadsheet and Presentation Graphics Software skills.

Detailed Contents	Contact hours
Unit-I **Human Computer Interface** Concepts of Hardware and Software; Data and Information. **Devices:** Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter. (Brief introduction of all) **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.	7
Unit-II **Word processing:** Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors. **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.	**7**
Unit-III **DBMS:** Introduction of DBMS, Data Modeling for a Database, Three level Architecture of DBMS, Components of a DBMS. **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.	**8**

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, Topologies.	

Text Books:

1. Fundamentals of Computers, V Rajaraman,NAdabala, PHI.
2. Computer Fundamentals and Programming in C, Reema Thareja, Oxford University Press, 2016.
3. Introduction to Information Technology, ITL Education Solutions limited, Pearson Education
4. Computer Fundamentals, A. Goel, 2010, Pearson Education.
5. Computer Course Windows 10 with MS Office 2016, Satish Jain (Author), BPB Publications.

Reference Books:

1. “Introduction to Computers”, Peter Norton

Course Code: PGCA1917
Course Name: Discrete Structures &Optimization

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: Basic Mathematical Knowledge
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Apply the operations of sets and use Venn diagrams to solve applied problems; solve problems using the principle of inclusion-exclusion
CO2	Apply rules of inference, proof by contradiction, proof by cases, and write proofs using symbolic logic and Boolean Algebra
CO3	Solve counting problems by applying elementary counting techniques using the product and sum rules, permutations, combinations, the pigeon-hole principle.

CO4	Determine if a given graph is simple or a multigraph, directed or undirected, cyclic or acyclic, and determine the connectivity of a graph.

Detailed contents	Contact hours
Part A **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. **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, Karnaughmap) **Combinatorial Mathematics:** Basic counting principles, Permutations and combinations, Inclusion and Exclusion, Principle Recurrence relations, Generating Function, Pigeon Hole Principle, Application	24 Hours
Part B **Monoids and Groups:** Groups, Semigroups and monoids, Cyclic semigraphs and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups. **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.	20 Hours

Text Books:

1. Discrete Mathematics (Schaum series), Lipschutz (McGraw Hill).
2. Applied Discrete Structures for Computer Science, Alan Doerr and Kenneth Levarseur (Creative Commons) 2012.

Reference Books:

1. Discrete Mathematics and its Applications, Kenneth H Rosen.(McGraw Hill)
2. Discrete Mathematics and Graph Theory, Sartha, (Cengage Learning)
3. Elements of discrete mathematics. C L Liu (McGraw Hill)

Course Code: PGCA1951
Course Name: Programming in Python

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits**: 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems**: -
Internal max. marks: 30	**Duration of end semester exam (ESE):**3hrs
External max. marks:70	**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**
Part- A **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. **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. **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).	22 hours
Part- B **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. **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.	22 hours

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: PGCA1952
Course Name: Advanced Data Structures

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 1st	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	Choose appropriate data structures and algorithms and use it to design solution for a specific problem.
CO2	Execute the operations of hashing to retrieve data from data structure.
CO3	Design and analyze programming problem statements
CO4	Come up with analysis of efficiency and proofs of correctness
CO5	Comprehend and select algorithm design approaches in a problem specific manner.

Detailed contents	**Contact hours**
Part A Introduction to Data Structures: Data Structures and its Types, Algorithms, Time Complexity, Recurrence, Probabilistic Analysis, Amortized Analysis, Competitive Analysis.	22 Hours

Sorting Algorithms: Quick Sort, Heap Sort, Counting Sort, Bucket Sort, Multi-way Merge Sort. Hashing Techniques: Direct Address Tables, Hash Tables, Hash Functions, Open Addressing, Perfect Hashing. Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Binomial Heaps, Fibonacci heaps, Data Structures for Disjoint Sets.	
Part B Graphs & Algorithms: Graphs Representation, Minimum Spanning Tree (MST), Single Source Shortest Paths, All Pairs Shortest Paths, Maximum Flow. String Matching: String, String Length, String Concatenation, String Copy, String-Matching, Brute Force algorithm, Rabin Karp algorithm, Knuth-Morris-Pratt (KMP) algorithm, Boyer–Moore algorithm.	22 Hours

Text Books:

1. Thomas Coremen, “Introduction to Algorithms”, Third edition, Prentice Hall of India, 2009.

Reference Books:

1. Kleinberg J., Tardos E., “Algorithm Design”, 1st Edition, Pearson, 2012.
2. Aho Alfred V., Hopperoft John E., UIlman Jeffrey D., “Data Structures and Algorithms”, Addison Wesley, 2001.
3. Seymour Lipschutz, “Data structure”, Indian Adapted Edition, Tata McGraw Hill, 200

Course Code: PGCA 1953
Course Name: Advanced Database Management System

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 1^{st}	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Express the basic concepts of DBMS and RDBMS.
CO2	Apply normalization theory to the normalization of a database
CO3	Apply the concept of Transaction Management & Recovery techniques in RDBMS.
CO4	Analyze various advanced databases prevailing in market, Big Data, Temporal Databases, Parallel and Distributed Databases, XML Database and multidimensional Databases
CO5	Demonstrate No SQL databases (Open Source)

Detailed contents	Contact hours
Part A Need of DBMS over traditional Data storage mechanisms, Basic DBMS terminologies; Architecture of a DBMS: Data Independence, DBMS Component Structure, DBMS USERS, various DBMS Data Models, **Conceptual Model**: Entity Relationship Model, Importance of ERD, Symbols (Entity:Types of Entities, week Entity, Composite Entity, Strong Entity, Attribute: Types of Attribute, Relationship: Type of relationship, Connectivity, Cardinality). **Normalization** and its various forms, Functional Dependencies, Multi-valued Dependencies, Join Dependencies Database Integrity: Domain, Entity, Referential Integrity Constraints **Relational Languages**: Relational Algebra, Relational Calculus, Query Execution, optimization and evaluation Plans. **Transaction Management and Concurrency Control** techniques, Database Recovery Management Concepts and methods. Introduction and Need of **Database Administration** and activities of Database administration.	22 Hours
Part B **Parallel Databases :** Database System Architectures: Centralized and Client-Server Architectures – Server System Architectures – Parallel Systems-Parallel Databases: I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra operation Parallelism **Distributed Database Concepts** : Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing **Multidimensional Databases** and their uses in data analytics. **Temporal Databases :** Introduction to Temporality, Temporal relationships, temporal hierarchies.	22 Hours

Spatial Databases: Spatial data types, spatial relationships, Topological Relationships, Spatial Data Structures and methods of storage. **Big Data :** introduction: introduction to **NOSQL Databases** (Open Source only). Need and usage of **XML Databases:** XML Data Model – DTD – XML Schema	

Text Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, "Database System Concept", Sixth Edition, 2013, McGraw-Hill
2. Bipin C. Desai, "An Introduction to Database System" , Revised Edition, 2012, Galgotia Publications Pvt Ltd-New Delhi

Reference Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications
2. Peter Rob Carlos Coronel, "Database Systems", Cengage Learning, 8th ed.
3. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", 8th Edition, 2006, Pearson Education.

Course Code: PGCA1905
Course Name: Technical Communication

Program: MCA	**L:**3 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 3
Semester: 1st	**Contact hours:** 33 hours
Internal max. marks: 30	**Theory/Practical:** Theory
External max. marks: 70	**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	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in reading & listening, comprehension, writing and speaking skills.
CO3	Students will be able to understand spoken and written English language, particularly the language of their chosen technical field.

CO4	They will be able to converse fluently.
CO5	They will be able to produce on their own clear and coherent texts.

Detailed contents	Contact hours
Part A **Basics of Technical Communication:**Functions of Communication-Internal & External Functions, Models-Shannon & Weaver's model of communication, Flow, Networks and importance, Barriers to Communication, Essential of effective communication (7C's and other principles), Non-verbal Communication. **Basic Technical Writing:** Paragraph writing (descriptive, Imaginative etc.), Precise writing, reading and comprehension, Letters– Format &various types.	16 Hours
Part B **Advanced Technical Writing:** Memos, Reports, E-Mails & Net etiquettes, Circulars, Press Release, Newsletters, Notices. Resume Writing, Technical Proposals, Research Papers, Dissertation and Thesis, Technical Reports, Instruction Manuals and Technical Descriptions, Creating Indexes, List of References and Bibliography. **Verbal Communication:**Presentation Techniques, Interviews, Group Discussions, Extempore, Meetings and Conferences. **Technical Communication:**MS-Word, Adobe Frame maker and ROBO Help * Lab Exercises based on Listening and Speaking skills	17 Hours

Text Books:

1. Vandana R Singh, The Written Word, Oxford University Press, New Delhi.
2. K KRamchandran, et al Business Communication, Macmillan, New Delhi.
3. Swati Samantaray, Business Commnication and Commnicative English, Sultan Chand, New Delhi.
4. S.P. Dhanavel English and Communication Skills for Students of Science and Engineering (with audio CD).

Course Code: PGCA1954
Course Name: Data Structures using Python Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:** 2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of concepts of Data Structures
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the concept of data structures, python and apply algorithm for solving problems like Sorting, searching, insertion and deletion of data.
CO2	Implement linear and non-linear data structures for processing of ordered or unordered data.
CO3	Analyze various algorithms based on their time and space complexity.

LIST OF EXPERIMENTS	
1	Write a Python program to create an array of 5 elements and display the array items. Access each individual element through indexes.
2	Write a Python program to reverse the order of the items in the array.
3	Write a Python program to append a new item to the end of the array.
4	Write a Python program to remove a specified item using the index from an array.
5	Write a Python program to get the length of an array.
6	Write a Python program for binary search.
7	Write a Python program for sequential or linear search.
8	Write a Python program to sort a list of elements using the bubble sort algorithm.
9	Write a Python program to sort a list of elements using the selection sort algorithm.
10	Write a Python program to sort a list of elements using the insertion sort algorithm.
11	Write a Python program to sort a list of elements using the quick sort algorithm.
12	Write a Python program to create a singly linked list, append some items and iterate through the list.
13	Write a Python program to find the size of a singly linked list.
14	Write a Python program to search a specific item in a singly linked list and return true if the item is found otherwise return false.
15	Write a Python program to delete the first item from a singly linked list.
16	Write a Python program to create circular single linked lists.
17	Write Python programs to implement stack and its operations using list.
18	Write Python programs to implement queue and its operations using list.

19	Write a Python program to create a Balanced Binary Search Tree (BST) using an array (given) elements where array elements are sorted in ascending order.
20	Write a Python program to find the kth smallest element in a given a binary search tree.
21	Write a Python program to traverse the binary tree using pre-order, post-order and in-order traversals.
22	Write a Python program to count the number of nodes in binary search tree.
23	Write a Python program to traverse the graph using Depth First Search and Breadth First Search
24	Write a Python program to create Red Black Tree and perform operations of Insertion and Deletion in it.
25	Write a Python program to implement AVL Trees as well as various operations of searching, insertion and deletion on AVL Trees.

Text Books:

1. Benjamin Baka, David Julian, "Python Data Structures and Algorithms", Packt Publishers, 2017.
2. Y Daniel Liang, "Introduction to Programming using Python", Pearson.
3. Rance D. Necaise, "Data Structures and Algorithms using Python", Wiley Student Edition.

Reference Books:

1. Hemant Jain, "Problem Solving in Data Structures and Algorithms using Python: programming interview guide", 2016.
2. Zed A. Shaw, "Learn Python the Hard Way: a very simple introduction to the terrifyingly beautiful world of computers and code", 3e, Addison-Wesley, 2014.

Course Code: PGCA1955
Course Name: Advanced Database Management System Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 1st	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**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	Implement query a database using SQL DML/DDL commands.

CO2	Analyze integrity constraints on a database
CO3	Develop PL/SQL programs including stored procedures, stored functions, cursors
CO4	Design new database and modify existing ones for new applications and reason about the efficiency of the result.
CO5	Implement various DBA roles/techniques

S.No.	Practical Assignments
1.	Database design using E-R model and Normalization (Any 3 systems).
2.	Implementation of DDL Commands to perform creation of table, alter, modify and drop column operations.
3.	Implementation of Constraint ▪ Check Constraint ▪ Entity Integrity Constraint ▪ Referential Integrity Constraint ▪ Unique Constraint ▪ Null Value Constraint
4.	Implementation of DML and DCL Commands.
5.	Implementation of Data and Built in Functions in SQL.
6.	Implementation of Nested Queries and Join Queries.
7.	Implementation of Cursors.
8.	Implementation of Procedures and Functions.
9.	Implementation of Triggers.
10.	Implementation of Embedded SQL.
11.	Consider a Database applications, Design and Develop Conceptual Data Model (E-R Diagram) with all the necessary entities, attributes, constraints and relationships. Design and build Relational Data Model for application specifying all possible constraints.
12.	Implementation of various DBA roles/techniques ▪ Creation of user ▪ Granting of privileges to the users ▪ Creation of roles ▪ Loading of privileges into user defined roles. ▪ Import/Export data between various databases and flat files

Text Books:

1. Ivan Bayross, "SQL, PL/SQL The Programming Language of Oracle", 4th Revised Edition,2009, BPB Publications.
2. Steven Feuerstein and Bill Pribyl, "Oracle PL/SQL Programming", 5th Edition, 2009, O'Reilly Media.

Course Code: PGCA1908

Course Name: Technical Communication Laboratory

Program: MCA	**L**:0 **T**:0 **P**:2
Branch: Computer Applications	**Credits:** 1
Semester: 1st	**Contact hours:** 2 hours per week
Internal max. marks: 30	**Theory/Practical:**Practical
External max. marks: 20	**Duration of end semester exam (ESE): -**
Total marks: 50	**Elective status:**Ability Enhancement

Prerequisite: -NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes:

CO#	Course outcomes
CO1	The objective of the course is to help the students become the independent users of English language.
CO2	Students will acquire basic proficiency in listening and speaking skills.
CO3	Students will be able to understand spoken English language, particularly the language of their chosen technical field.
CO4	They will be able to converse fluently
CO5	They will be able to produce on their own clear and coherent texts.

Assignments:

Interactive practice sessions in Language Lab on Oral Communication	
1.	Listening Comprehension
2.	Self-Introduction, Group Discussion and Role Play
3.	Common Everyday Situations: Conversations and Dialogues
4.	Communication at Workplace
5.	Interviews
6.	Formal Presentations

Text Books:

1. Practical English Usage. Michael Swan. OUP. 1995.
2. Communication Skills. Sanjay Kumar and Pushp Lata. Oxford University Press. 2011.
3. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Course Code: PGCA1909
Course Name: Web Technologies

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits**: 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
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: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the basics of Internet and Web Services.
CO2	Describe and differentiate Programming Language and Markup Language.
CO3	Connect 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.

Detailed Contents	Contact hours
Part-A **Internet Basics:** Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address, How IP addressing came into existence? A brief overview TCP/IP and its services, transmission control protocol. **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,	24 hours

Drawing Lines), Text Styles (Bold, Italics, Underline), Other Text Effects (Centering (Text, Images etc.), Spacing (Indenting Text), HTML Color Coding. **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. 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 Tag.	
Part-B **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 **Introduction to JavaScript:** Introduction to JavaScript: JavaScript in Web Pages (Netscape and JavaScript, Database Connectivity, Client side JavaScript, Capturing User Input); The Advantages of JavaScript (an Interpreted Language, Embedded within HTML, Minimal Syntax -Easy to Learn, Quick Development, Designed for Simple, Small Programs, Performance, Procedural Capabilities, Designed for Programming User Events, Easy Debugging and Testing, Platform Independence/Architecture Neutral); Writing JavaScript into HTML. **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) Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element) Other Built-In Objects in JavaScript (The String Object, The Math Object, The Date Object), User Defined Objects (Creating a User Defined Object, Instances, Objects within Objects).	20 hours

Text 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. RajKamal, "Internet& Web Technologies",edition Tata McGraw-Hill Education.2009.
4. Chris Payne, "Asp in 21 Days", 2nd Edition, Sams Publishing, 2003 PDCA.
5. A Beginner's Guide to Html Http://www.Ncsa.Nine.Edit/General/Internet/Www/Html.Prmter

E-Books/ Online learning material:

1. https://www.tutorialspoint.com/html/html_tutorial.pdf
2. https://www.w3schools.com/js/
3. https://www.w3schools.com/html/
4. https://www.cs.uct.ac.za/mit_notes/web_programming.html
5. http://www.pagetutor.com/table_tutor/index.html

Course Code: PGCA1920
Course Name: Design & Analysis of Algorithms

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Student must have knowledge about Data Structures**.**
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	**Course outcomes**
CO1	Categorize problems based on their characteristics and practical importance
CO2	Develop Algorithms using iterative/recursive approach
CO3	Design algorithm using an appropriate design paradigm for solving a given problem
CO4	Classify problems as P, NP or NP Complete

Detailed contents	**Contact hours**
Part A	24 Hours

Algorithms: Analyzing algorithms, order arithmetic, 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. Principles of Algorithm Design. Mathematical analysis of Recursive and Non-recursive algorithms. **Basic Algorithm Design Techniques:** Divide-and-conquer, Greedy approach, Randomizationand dynamic programming. **Example problems on Backtracking:** n-Queens problem, Hamiltonian Circuit Problem, Subset – Sum Problem. Branch-and- Bound: Assignment Problem, Knapsack Problem, Traveling Salesperson Problem.	
Part B **Sorting and searching:** Insertion and selection sort, 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. Exhaustive search and String Matching. **Graphs and NP-completeness:** Graph traversal: Breadth-First Search(BFS) and Depth-First Search (DFS). Applications of BFS and DFS. Shortest paths in graphs: Dijkstra algorithm. Definition of class NP, P, NP-hard and NP-complete problems.	20 Hours

Text Books:

1. Horowitz E., Sahani S., Rajasekharan S.: Computer Algorithms, Galgotia Publication
2. A.V.Aho, J.E.Hopcroft, and J.D.Ullman, The Design and Analysis of Computer Algorithms, Pearson Education India
3. J.Kleinberg and E.Tardos, Algorithm Design by, Pearson Education India
4. Coremen T.H., Leiserson C.E., and Rivest R.L.: Introduction to Algorithms, PHI

Reference Books:

1. Anany Levitin: Introduction to the Design and Analysis of Algorithms, Pearson Education, 2nd Edition.
2. Michael T Goodrich and Roberto Tamassia : Algorithm Design, Wiley India
3. R C T Lee, S S Tseng, R C Chang, Y T Tsai : Introduction to Design and Analysis of Algorithms: A Strategic Approach, Tata McGraw Hill

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Course Code: PGCA1918
Course Name: Advanced Java

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite: -Understanding of Core Java concepts.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Learn the advanced features of Java and write the programs.
CO2	Work with API and implement Serialization concept of Java.
CO3	Learn Java Generics and develop Projects.

Detailed contents	Contact hours
Part A **Servlets:** The life cycle of Servlet, Java Servlet Development kit, Servlet API, Reading the servletparameters, Reading initialization parameters, Handling HTTP requests and responses, Using cookies, Session tracking and security issues. **Java Server Pages (JSP):** JSP Architecture, Life cycle of JSP, JSP syntax basics–Directives,Declarations, Scripting, Standard actions, Custom tag libraries, Implicit objects, Object scope. Synchronization issues, Session management. **Struts :** Introduction to struts framework, understanding basic architecture of Model, view, controller. Deploying the application in struts with database connectivity.	22 Hours
Part B **Hibernate :** Introduction to hibernate framework, understanding basic architecture of Model, view, controller. Basic concepts of creating pojo files, reverse mapping, object creation in hibernate ,database connectivity . **Enterprise Java Bean:** The bean developer kit (BDK), Use of JAR files, The java beans API,Creating a JavaBean, Types of beans, Stateful session bean, Stateless session bean, Entity bean. **Remote Method Invocation:** Defining the remote interface, Implementing the remote interface, Compiling and executing the server and the client. **Common Object Request Broker Architecture (CORBA):** Overview of	22 Hours

technical architecture, CORBA basics, CORBA services.	

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, "Advanced Java 2 Platform HOW TO PROGRAM", Prentice Hall.

Reference Books:

1. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.
2. Philip Hanna, "JSP: The Complete Reference", Tata McGraw –Hill.

Course Code: PGCA1956
Course Name: Linux Administration

Program: MCA	**L**:4 **T**:0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 2^{nd}	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Core
Total marks: 100	

Prerequisite:
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the technical details of Linux operating system
CO2	Work with various Linux command and understand file hierarchical structuring
CO3	Administrate user, manage and configure packages in Linux
CO4	Know and configure the various internet services.

Detailed contents	Contact hours
Part A **Introduction:** Linux: The Operating System: Linux Distributions, Difference Between Linux and Windows, Separation of the GUI and the Kernel, Understanding Linux Kernel, Installing Linux in a Server Configuration, Booting and Shutting Down Process,Concept of Root, Basic	22 Hours

commands, working with vi Editor, **Understanding files and File System:**Understanding Files and Directories in Linux, File Structure and hierarchy, File Permissions, File Management and Manipulation, Managing File System **Managing Packages & Users:** Installing and removing Software in Linux, Getting and Unpacking the Package, Configuring the Package, Compiling the Package, Installing the Package, Managing Users and Groups	
Part B **DNS:** Installing a DNS Server, Configuring a DNS Server, DNS Records Types, Setting Up BIND Database Files, The DNS Toolbox, Configuring DNS Clients. **Web Server:** Understanding the HTTP Protocol, Installing the Apache HTTP Server, Starting Up and Shutting Down Apache, Configuring Apache **E-Mail Server:** Understanding SMTP, Installing the Postfix Server, Configuring the Postfix Server, Running the Server, POP and IMAP Basics,Installing the UW-IMAP and POP3 Server **Samba Server:** The Mechanics of SMB, Samba Administration, Using SWAT, Creating a Share, Mounting Remote Samba Shares, Creating Samba Users, Using Samba to Authenticate Against a Windows Server	22 Hours

Text Books:

1. Linux Administration: A Beginner’s Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India

Course Code: PGCA1932
Course Name: Information Security and Cyber Law

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 2nd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Acquire knowledge about various Information Systems.
CO2	Understand the key security requirements of Confidentiality, Integrity &Availability.
CO3	Demonstrate the concept of Intrusion Detection & Intrusion Prevention.
CO4	Apply Symmetric Encryption techniques.
CO5	Describe the concept of Security policies and Cyber Laws.

Detailed contents	Contact hours
Part A Introduction to Information System, classification and components of information system, Computer Security Concepts, CIA (Confidentiality, integrity and availability),Security Functional Requirements. User Authentication: Means of Authentication, Password-Based Authentication, Token-Based Authentication, Biometric Authentication, Remote User Authentication, Security Issues for User Authentication. **Access Control:** Access Control Principles, Subjects, Objects, and Access Rights, Discretionary Access Control, File Access Control, Role-Based Access Control. **Database Security:** The Need for Database Security, Database Access Control, Database Encryption. **Malicious Software:** Types of Malicious Software (Malware)-Viruses, Worms,SPAM E-mail, Trojans, Zombie, Bots, Keyloggers, Phishing, Spyware, Backdoors, Rootkits, Preventive Measures.Denial-of-Service Attacks: Types of DoS attacks, Defenses Against Denial-of-Service	22 Hours

Attacks.	
Part B **Intrusion Detection:** Intruders, Intrusion Detection, Host-Based Intrusion Detection, Distributed Host-Based Intrusion Detection, Network-Based Intrusion Detection, Honeypots. **Firewalls & Intrusion Prevention Systems:** The Need for Firewalls, Firewall Characteristics, Types of Firewalls, Firewall Basing, Intrusion Prevention Systems. **Cryptographic Algorithms:** Symmetric Encryption Principles, Data Encryption Standards (DES) **Introduction to Internet Security Protocols & Standards:** SSL, TLS, HTTPS, IPv4 and IPv6 Security protocols. **Security Policies and Cyber Laws:** Concept of Information Security Policy, ISO Standards, various Indian Cyber Laws, Information Technology Act 2000, Electronic Record and E-Governance, Classification and Provisions of Cyber Crimes, Regulation of Certifying Authorities, Patent, Copyright, Digital signature, Introduction to Cyberspace.	22 Hours

Text Books:

1. William Stallings, Lawrie Brown, "Computer Security: Principles & Practice", 3rd Edition, Pearson, 2015.
2. Surya Prakash Tripathi, RitendraGoel, Praveen Kumar Shukla, "Introduction to Information Security and Cyber Laws", Wiley India,2014.

Reference Books:

1. Christof Paar , Jan Pelzl, "Understanding Cryptography: A Textbook for Students and Practitioners", 1st Edition, Springer, 2010
2. William Stallings, "Cryptography and Network Security Principles and Practices", 4th Edition, Prentice Hall, 2006.
3. Darren Death, "Information Security Handbook", Packt Publishing, 2017

Course Code: PGCA1914
Course Name: Web Technologies Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 2nd	**Contact hours:**4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of End Semester Exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Core
Total marks: 100	

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:

- 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	Understand Static and Dynamic concepts of web designing.
CO2	Develop ability to retrieve data from a database and present it online.
CO3	Design web pages that apply various dynamic effects on the web site.
CO4	Solve complex and large problems using Scripting Language & Markup Language.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Design index page of a book Titled Web Designing.
2.	Create a simple HTML page to demonstrate the use of different tags.
3.	Display Letter Head of your college on a web page & it must be scrolling Right to Left.
4.	Create a link to move within a single page rather than to load another page.
5.	Display “Name of University” using different Text formatting Tags.
6.	Design Time Table of your department and highlight 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 display logo of your college in left pane and logo of university in right pane.
10.	Create Bio- Data of an employee.
11.	Design front page of a hospital with different styles.

12.	Design a web page and display horizontally two different web pages at a time.
13.	Write a program to create a login form. On clicking the submit button, the user should get navigated to a profile page.
14.	Write a HTML code to create a Registration Form. On submitting the form, the user should be asked to login with the new credentials.
15.	Write a HTML code to create website in your college or department and create link for Tutorial of specific subject.
16.	Write a program to perform following operations on two numbers input by the user: Addition 2) Subtraction 3) Multiplication 4) Division.
17.	Design a program to solve quadratic equations.
18.	Write a program to determine greatest number of three numbers.
19.	Write a script to compute, the Average and Grade of students marks.
20.	Design a scientific calculator and make event for each button using scripting language.
21.	Write a script to check whether a number is even or odd?
22.	Write a program to show whether a number is prime or not?
23.	Write a program to show multiplication table of any number.
24.	Write a program to find the factorial of any number.
25.	Write a program to show Fibonacci Series between 0 to 74.

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/ 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: PGCA1922
Course Name: Advanced Java Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**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	Learn the advanced features of Java and write the programs.
CO2	Work with API and implement Serialization concept of Java.
CO3	Learn Java Generics and develop Projects.
CO4	Understand to use digital marketing for developing effective digital and social media strategies

S.No.	Practical Assignments (Java)
1.	Create a Servlet to handle HTTP Requests and Responses.
2.	Implementation of the concept of Cookies and Session Tracking.
3.	Illustrate the concept of JavaServer Pages (JSP).
4.	Create a JavaBean by using Bean Developer Kit (BDK).
5.	Implementation of various types of beans like Session Bean and Entity Bean.
6.	Introduction to Struts platform with basic connectivity.
7.	Deploying first sample program using MVC architecture in struts.
8.	Implementing database connectivity in struts.
9.	Creating one sample application in struts.
10.	Introduction to Hibernate framework.
11.	Creating simple Hibernate application.
	Practical Assignments (SEO)
12.	Take a web site and prepare the SEO report of the website including status of following factors: Title tag, meta-description tag, header tags, keyword consistency, number of back links, robots.txt and xml sitemaps then after going through the steps of SEO prepare the report.
13.	Discuss any five tools to prepare the list of ten organic key words for SEO purpose.
14.	Optimize the images in the website using suitable methods and compare the reports before and after the SEO steps.
15.	Write the robot and sitemap file of a website under consideration.

Text Books:

1. Herbert Schildt , "The Complete Reference Java 2" , Tata McGraw -Hill.
2. H.M. Deital, P.J. Dietal and S.E. Santry, "Advanced Java 2 Platform How To Program", Prentice Hall.
3. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education

4. 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. Grey Cornell and Hortsmann Cay S., "Core Java", Sun Microsystems Press.
2. Philip Hanna, "JSP: The Complete Reference", Tata McGraw –Hill..

Course Code: PGCA1957

Course Name: Linux System Administration Laboratory

Program: MCA	**L**: 0**T**:0 **P**: 4
Branch: Computer Applications	**Credits:**2
Semester: 2nd	**Contact hours:** 4 hours per week
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:70	**Duration of end semester exam (ESE): -**
External max. marks:30	**Elective status:** Core
Total marks: 100	

Prerequisite:

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Install Linux desktop and Linux server operating system.
CO2	Use various commands for performing different operations
CO3	Work with various Linux administration commands
CO4	Install and configure various servers in Linux environment

Lab Practicals

S.No	Practical Assignments
1	Installation of Linux operating system. a. Partitioning drives b. Configuring boot loader (GRUB/LILO) c. Network configuration d. Setting time zones e. Creating password and user accounts f. Installing and removing packages g. Shutting down
2.	Working with basic commands
3.	Linux system administration a. Becoming super user b. Temporarily changing user identity with su command c. Using graphical administrative tools

	d. Administrative commands e. Administrative configuration files
4.	Configuring NICs with Network Device Configuration Utilities (ip and ifconfig)
5.	Install and configuring a DNS Server with a domain name of your choice.
6.	Install and configuring DHCP server and client
7.	Install and configuring Mail Server
8.	Install and configuring Apache Web Server for hosting websites
9.	Securing a simple network with Linux firewall (Netfilter/iptables)
10.	Setting up Samba Server to share files and printers with Windows-based and other operating systems

Text Books:

1. Linux Administration: A Beginner's Guide, Wale Soyinka, McGrawHill
2. UNIX and Linux system administration Handbook Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Dan Mackin, Pearson Education
3. Linux Command Line and Shell Scripting Bible, 3rd Edition Richard Blum, Christine Bresnahan, Wiley

Reference Books:

1. Linux: The Complete Reference, Sixth Edition, Richard Petersen McGrawHill
2. Linux All-In-One for Dummies, Emmett Dulaney, Wiley India.

Course Code: PGCA1925
Course Name: Advanced Computer Networking

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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 the different Network Models.
CO2	Understand different protocols working at Medium Access Sub layer.
CO3	Learn the concept of network routing through algorithms.
CO4	Learn and understand Internet protocols and network security.

Detailed contents	Contact hours
Part A **Computer Networks**: Uses of computer Networks, Goals and applications of networks, Computer Network Structure and Architecture, Reference models: OSI model **Physical Layer:** Concept of Analog & Digital Signal, Bandwidth, Transmission Impairments: Attenuation, Distortion, Noise, Multiplexing : Frequency Division, Time Division, Wavelength Division, Introduction to Transmission Media : Twisted pair, Coaxial cable, Fiber optics, Wireless transmission (radio, microwave, infrared) **Data Link Layer**: Design issues, Framing, Error detection and correction codes: parity, 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. **Network Layer:** Design issues, IPv4 classful and classless addressing, subnetting, Routing algorithms: distance vector, Congestion control: Principles of Congestion Control, Congestion prevention policies, Leaky bucket and token bucket algorithms **Medium Access Sub-Layer**: Static and dynamic channel allocation, Random Access: ALOHA, CSMA-CA/CD protocols, Controlled Access: Polling, Token Passing **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. **Application Layer:** World Wide Web (WWW), Domain Name System (DNS), E-mail, File Transfer Protocol (FTP) TCP/IP model, Comparison of TCP/IP and OSI models.	22 Hours
Part B An Overview of Select Wireless and Mobile Networking Technologies: Principles, WLANs: IEEE 802.11,Cellular Networks, Issues in Seamless Mobility **Adhoc networks:** Features, advantages and applications, Adhoc versus Cellular networks, Network architecture, Protocols: MAC protocols, Routing protocols, Technologies. **Wireless Communication Systems**: Evolution, examples of wireless communication systems, 2G Cellular networks, Evolution for 2.5G TDMA Standards, IS-95B for 2.5G CDMA.	22 Hours

Wireless System Design: Introduction, Frequency reuse, channel assignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems.	

Text Books:

1. A.S. Tannenbaum, "Computer Networks", 3rd Edition, Prentice Hall, 1999.
2. Data Communications & Networking by Forouzan, Tata McGraw Hills.
3. Larry L. Peterson & Bruce S. Davie: Computer Networks: A Systems Approach, 5th Edition, Morgan Kaufmann / Elsevier, New Delhi, 2012, reprint 2016.
4. James F. Kurose & Keith W. Ross: Computer Networking: A Top-Down Approach, 7 th Edition, Pearson Education Inc. Boston, 2016.

Reference Books:

1. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
2. D. Bertsekas and R.Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Stevens W.R.," UNIX Network Programming," Prentice Hall, 1990.

Course Code: PGCA1926
Course Name: Artificial Intelligence & Soft Computing

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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 significance and domains of Artificial Intelligence and knowledge representation.
CO2	Examine the useful search techniques; learn their advantages, disadvantages and comparison.
CO3	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.

CO4	Apply artificial neural networks and fuzzy logic theory for various problems.
CO5	Determine the use of Genetic algorithm to obtain optimized solutions to problems.

Detailed contents	Contact hours
Part A **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. **Informed (Heuristic) Search Strategies-**Hill Climbing, Simulated Annealing, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search. **Natural language processing:** Grammars, Parsing, Semantic Analysis and Pragmatics.	22 Hours
Part B **Introduction:** What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing. **Neural Networks:** Introduction, What is Neural Network, Learning rules and various activation functions, Supervised Learning Networks, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP)Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications. Unsupervised Learning Networks. **Fuzzy Systems:** Fuzzy Set theory, Fuzzy vs. Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification. **Genetic Algorithm:** History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators-Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization. Introduction to Hybrid Systems.	22 Hours

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. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
4. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications, S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:

1. Artificial Intelligence-A new Synthesis, Nils J. Nilsson, Morgan Kaufmann Publishers.
2. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
3. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

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Course Code: PGCA1927
Course Name: Theory of Computation

Program: MCA	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 30	**Duration of end semester exam (ESE):**
External max. marks:70	**Elective status: core/elective** 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	Use basic concepts of formal languages of finite automata techniques.
CO2	Design Finite Automata's for different Regular Expressions and Languages.
CO3	Construct context free grammar for various languages.
CO4	**S**olve various problems of applying normal form techniques, push down automata and Turing Machines.
CO5	**S**olve computational problems regarding their computability and complexity and prove the basic results of the theory of computation.

Detailed contents	Contact hours
Part A Formal Language, Non-Computational Problems, Diagonal Argument, Russels's Paradox. **Theory of Automata:** Deterministic Finite Automaton (DFA), Non-Deterministic Finite Automaton (NDFA), Equivalence of DFA and NDFA, Mealy and Moore Models, Minimization of Finite Automata. **Regular Sets and Regular Grammars:** Regular Languages, Regular Grammars, Regular Expressions, Properties of Regular Language, Pumping Lemma, Non-Regular Languages, Lexical Analysis. **Context Free Language:** Properties of Context Free Language, Chomsky Classification of Languages, Context Free Grammar, Simplification of Context Free Grammar, Chomsky Normal Form, Greibach Normal Form.	22 hours
Part B **Push Down Automata:** Ambiguity, Parse Tree Representation of Derivation Trees, Equivalence of PDA's and Pushdown Automaton (PDA), Non-Deterministic Pushdown Automaton (NPDA). **Turing Machines (TM):** Standard Turing Machine and its Variations; Universal Turing Machines, Models of Computation and Church-Turing Thesis. **Recursive and Recursively-Enumerable Languages;** Context-Sensitive Languages, Unrestricted Grammars, Chomsky Hierarchy of Languages, Construction of TM for Simple Problems. **Unsolvable Problems and Computational Complexity:** Unsolvable Problem, Halting Problem, Post Correspondence Problem, Unsolvable Problems for Context-Free Languages, Measuring and Classifying Complexity, Tractable and Intractable Problems.	22 hours

Text Books:

1. Jeffrey Ullman and John Hopcroft, Introduction to Automata Theory, Languages, and Computation, 3e, Pearson Education India (2008).
2. K.L.P. Mishra, Theory of Computer Science: Automata, Languages and Computation, Prentice Hall India Learning Private Limited (2006).
3. John Martin, Introduction to Languages and the Theory of Computation, McGraw-Hill Higher Education (2007).

Reference Books:

1. Introduction to Computer Theory, Daniel. I.A. Cohen , John Wiley & Sons.

Course Code: PGCA1928

Course Name: Advanced Computer Networking Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):**
External max. marks: 30	**Elective status:** Core
Total marks: 100	

Prerequisite: Computer Networks
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Familiarize themselves with the different Network Models.
CO2	Understand working of different devices used to set up LAN.
CO3	Learn the concept of network routing.
CO4	Learn and understand Internet protocols and network security.

S.No.	Name of Experiment
1.	Familiarization with Networking Components and devices: LAN Adapters, Switches, Routers etc.
2.	Familiarization with Transmission media and Tools: Co-axial 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 File and Printer sharing.
7.	Designing and Implementing Class A, B, C Network.
8.	Subnet Planning and its Implementation.
9.	Installation of ftp server and client.
10.	To develop programs for simulating routing algorithms for Adhoc networks.
11.	To install any one open source packet capture software like packet tracer etc.
12.	To configure Wireless Local Loop.
13.	To configure WLAN.
14.	To configure Adhoc Networks.
15.	To install and configure wireless access points.

Text Books:

1. A.S. Tannenbaum, “Computer Networks", 3rd Edition, Prentice Hall, 1999.
2. “Data Communications & Networking”, Behrouz A. Forouzan, Fifth Edition,Tata McGraw Hill.

Reference Books:

1. D.E. Cormer," Computer Networks and Internet", 2nd Edition, Addison Wesley Publication, 2000.
2. D. Bertsekas and R.Gallagar, "Data Networks", 2nd Edition, Prentice-Hall, 1992.
3. Stevens W.R.," UNIX Network Programming," Prentice Hall, 1990.

Course Code: PGCA1929
Course Name: Artificial Intelligence & Soft Computing Laboratory

Program: MCA	**L**: 0**T**: 0 **P**: 4
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 4 hours per week
Theory/Practical: Practical	**Percentage of numerical/design problems: --**
Internal max. marks:70	**Duration of end semester exam (ESE):** 3hrs
External max. marks:30	**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	Develop the skills to gain a basic understanding of neural network theory and fuzzy logic theory.
CO2	Apply artificial neural networks and fuzzy logic theory for various problems.
CO3	Determine the use of Genetic algorithm to obtain optimized solutions to problems.

Instructions: Develop the assignments in MATLAB/Python.

Assignments:

1.	Use logic programming in Python to check for prime numbers.
2.	Use logic programming in Python parse a family tree and infer the relationships between the family members.
3.	Python script for building a puzzle solver.
4.	Implementation of uninformed search techniques in Python.
5.	Implementation of heuristic search techniques in Python.
6.	Python script for tokenizing text data.
7.	Extracting the frequency of terms using a Bag of Words model.
8.	Predict the category to which a given piece of text belongs.
9.	Python code for visualizing audio speech signal
10.	Python code for Generating audio signals

11.	Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights.
12.	Implement AND function using ADALINE with bipolar inputs and outputs.
13.	Implement AND function using MADALINE with bipolar inputs and outputs.
14.	Construct and test auto associative network for input vector using HEBB rule.
15.	Construct and test auto associative network for input vector using outer product rule.
16.	Construct and test heteroassociative network for binary inputs and targets.
17.	Create a back propagation network for a given input pattern. Perform 3 epochs of operation.
18.	Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy relations.
19.	Maximize the function $f(x)=x^2$ using GA, where x ranges form *0-25*. Perform 6 iterations.

Text Books:
1. Principles of Soft Computing, S.N. Sivanandam, S.N. Deepa, Wiley India
2. Artificial Intelligence with Python, Prateek Joshi, Packt Publishing.
3. Neural Networks, Fuzzy Logic and Genetic Algorithms: Synthesis & Applications,S.Rajasekaran, G. A. Vijayalakshami, PHI.

Reference Books:
1. Soft Computing: With Matlab Programming, N. P. Padhy, S. P. Simon, Oxford Higher Education
2. Neuro - Fuzzy & Soft Computing - C. T. Sun, E. Mizutani, J. S. R. Jang, Pearson

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Course Code: PGCA1930
Course Name: Software Project Management

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 70	**Elective status:** Elective-I
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand and practice the process of project management
CO2	Develop the scope of work, provide accurate cost estimates and to plan the various activities.

CO3	Understand and use risk management analysis techniques that identify the factors that put a project at risk and to quantify the likely effect of risk on project timescales
CO4	Identify the resources and people required for a project and to produce a work plan and resource schedule.

Detailed contents	Contact hours
Part A **Project Management Fundamentals**- Basic Definitions, Project Stakeholders and Organizational, Influences on Project Management, Project Management Processes, Project Initiating Processes. **Planning and Resourcing a Project** - Identifying Requirements, Creating the Work Breakdown structure, Developing the Project Schedule, Developing a Project Cost Estimate, Planning Quality, Organizing the Project Team, Planning for Potential Risks **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.	22 Hours
Part B **Executing and Managing a Project** -Project Executing Processes- Acquiring and Developing the Project Team, Managing the Project Team, Managing Stakeholder Expectations, Directing and Managing the Project while assuring Quality. **Project Monitoring and Controlling Processes** - Verifying and Controlling Scope, Managing Schedule and Cost, Controlling Quality, Monitoring and Controlling Risks. Integrated Change Control, Project Closing Process, 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. **Quality Management and People Management**- Introduction, Understanding Behaviour, Organizational Behaviour, Selecting The Right Person for The Job, Motivation, The Oldman – Hackman Job Characteristics Model, working in Groups, Organization and team	22 Hours

structures, Decision Making, Leadership, Organizational Structures, Stress, Health and Safety. Overview of project management tools for software.	

Text Books:

1. Bob Hughes, Mike Cotterell, “Software Project Management”, Tata McGraw Hill.
2. Royce, “Software Project Management: A Unified Framework, Pearson Education.

Reference Books:

1. Robert K. Wysocki, “Effective Software Project Management”, Wiley
2. Ian Sommerville, Software Engineering, Seventh Edition, Pearson Education.
3. R.S. Pressman, Software Engineering: A Practitioner's Approach, Sixth Edition, Tata McGraw-Hill.

Course Code: PGCA1971
Course Name: Optimization Techniques

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**Elective status:** Elective-I
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	Formulate and solve linear programming problems
CO2	Frame and resolve the transportation and assignment problems
CO3	Understand the Project Management problems using CPM
CO4	Find solution to two person zero-sum games

Detailed contents	Contact hours
Part A **Scope of Operations Research:** Introduction to linear and non-linear programming formulation of different models. **Linear Programming:** Geometry of linear programming, Graphical	24 Hours

method, Linear programming (LP) in standard form, Solution of LP by simplex method, Exceptional cases in LP, Duality theory, Dual simplex method, Sensitivity analysis. **Integer Programming:** Branch and bound technique.	
Part B **Transportation and Assignment Problem:** Initial basic feasible solutions of balanced and unbalanced transportation/assignment problems, Optimal solutions. **Project Management:** Construction of networks, Network computations, Floats (free floats and total floats), Critical path method (CPM), Crashing. **Game Theory:** Two person zero-sum game, Game with mixed strategies, Graphical method and solution by linear programming.	20 Hours

Text Books:

1.Chandra, S., Jayadeva, Mehra, A., Numerical Optimization and Applications, Narosa Publishing House, (2013).

2.Taha H.A., Operations Research-An Introduction, PHI (2007).

Reference Books:

1.Pant J. C., Introduction to optimization: Operations Research, Jain Brothers (2004)

2.Bazaarra Mokhtar S., Jarvis John J. and Shirali Hanif D., Linear Programming and Network flows, John Wiley and Sons (1990)

3.Swarup, K., Gupta, P. K., Mammohan, Operations Research, Sultan Chand & Sons, (2010).

Course Code: PGCA1972
Course Name: Data Mining and Business Intelligence

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-I
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 basic concepts of data warehouse and business intelligence
CO2	Perform various data warehouse-related problems
CO3	Analyze data and relate to real-world scenario
CO4	Deriving intrinsic facts from data

Detailed contents	Contact hours
Part A **Introduction: R**eporting and Analysing data, Raw data to valuable information-Lifecycle of Data, The building Blocks: Defining Features – Data Warehouses (DW) and Data Marts - Overview of the components – Metadata, Need, Basic elements, trends. Business Intelligence (BI) Definitions and Concepts, BI Process and Technology, BI Roles and Responsibilities **The Architecture of BI and DW:** BI and DW architectures and its types, Relation between BI and DW - OLAP and OLTP definition and its differences, Dimensional analysis: Drill-down and roll-up – slice and dice or rotation, schemas: Stars, snowflakes and fact constellations **Introduction to data mining (DM) and Data Preprocessing:** Motivation for Data Mining, Data Mining Definition, and Functionalities, Classification of DM Systems - DM task and its applications, Integration of a Data, KDD Process, Steps of pre-processing data - Data cleaning: Missing Values, Noisy Data - Data, Integration, and transformation - Data Reduction: Data cube aggregation, Dimensionality reduction - Data Compression	24 Hours
Part B **Concept Description and Association Rule Mining:** Introduction, Data Generalization and summarization-based characterization, Association Rule	20 Hours

Mining; Market basket analysis - basic concepts - Finding frequent item sets: Apriori algorithm - generating rules – Improved Apriori algorithm **Classification and Prediction:** Introduction, Issues regarding Classification and prediction: Classification methods: Decision tree, Bayesian Classification, Rule based, CART, Neural Network Prediction methods: Linear and nonlinear regression, Logistic Regression **Data Mining for Business Intelligence Applications:** Data mining for business Applications like Balanced Scorecard, Fraud Detection, Clickstream Mining, Market Segmentation, retail industry, telecommunications industry, banking & finance and CRM etc., **Introdcution to Advance Topics** Clustering, Spatial mining, web mining, text mining, Data Analytics Life Cycle: Big data Business Analytics, State of the practice in analytics role of data scientists, Hadoop architecture .	

Text Books:

1. J. Han, M. Kamber, “Data Mining Concepts and Techniques”
2. Arun K. Pujari, “Data Mining Techniques”.
3. M. Kantardzic, “Data mining: Concepts, models, methods and algorithms, John Wiley &Sons Inc.

Reference Books:

1. Paulraj Ponnian, “Data Warehousing Fundamentals”, John Willey.
2. G. Shmueli, N.R. Patel, P.C. Bruce, “Data Mining for Business Intelligence: Concepts, Techniques, and Applications in Microsoft Office Excel with XLMiner”, Wiley India.

Course Code: PGCA1973
Course Name: Enterprise Resource Planning

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-I
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	Analyse a business processes of different functional areas
CO2	Understand ERP & Related Technologies
CO3	ERP Implementation Strategies
CO4	Use and apply this knowledge in E Commerce & E Governance related applications.

Detailed contents	Contact hours
Part A **Basic ERP Concepts:** Enterprise-An overview, Benefits & Risk, Evolution and Structure, Conceptual Model of ERP. **ERP & Related Technologies:** Business Process Reengineering (BPR), Data Warehousing and Data Mining, OLAP, Product Life Cycle Management, Supply Chain management, CRM. **ERP Functional Module:** Introduction, Finance, Manufacturing, Human Resource, Plant maintenance, Material Management, Integration of ERP, Supply Chain and Customer Relationship Application.	22 Hours
Part B **ERP Implementation:** Implementation Challenges / Strategies / Methodologies, ERP Project Teams, Vendors and Consultants, Dealing with employee resistance, Training and Education, data migration, Project Management and monitoring. **Strategic Grid:** Useful guidelines for ERP Implementations. **Post Implementation :** Maintenance of ERP- Organizational and Industrial impact; Success and Failure factors of ERP Implementation. Calculation of	22 Hours

ROI of ERP implementation, Hidden costs, ERP success inhibitors and accelerators. **Emerging Trends on ERP**: Technologies in ERP Systems and Extended ERP, ERP Market Place and Dynamics, Future Directives in ERP; ERP E Commerce & E – Governance: Concept, frame work, area of application like public sector, service industry. **Case Studies:** Development and Analysis of ERP Implementations	

Text Books:

1. Alexis Leon, "Enterprise Resource Planning", TMH, 2nd Ed.
2. Vinod Kumar Garg and Venkitakrishnan N K, "Enterprise Resource Planning Concepts and Practice". PHI
3. V.K. Garg & N.K. Venkita Krishnan. "ERP Ware: ERP Implementation Framework", PHI.

Reference Books:

1. S Sadagopan, "ERP A Managerial Prospective" TMH
2. Rahul V. Altekar "Enterprise wide Resource Planning" , TMH
3. Joseph A Brady, Ellen F Monk, Bret Wagner, "Concepts in Enterprise Resource Planning", Thompson Course Technology
4. Sandoe, Corbitt, and Boykin, "Enterprise Integration", John Wiley, ©2001, ISBN 0-471-35993-9
5. Motiwalla and Thompson, "Enterprise Systems For Management", Pearson/Prentice Hall 2011

Course Code: PGCA1933
Course Name: Mobile Application Development

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective II
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	Know the components and structure of mobile application development frameworks for Android and iOS based mobiles.
CO2	Understand how to work with various mobile application development frameworks.

CO3	Design and implement the user interfaces of mobile applications.
CO4	Develop useful mobile applications using Google Android and Eclipse simulator.

Detailed contents	**Contact hours**
<u>Part A</u> **Introduction**: Mobile Applications –Characteristics and Benefits – Frameworks and Tools, Types, Application Model. Profiles of Mobile devices. **Building Blocks of Mobile Applications:** User Interface Designing, Layout, User Interface elements, Functionality based user interface, Naïve Data Handling, Sprucing up Mobile applications **Testing Mobile Applications:**Debugging Applications, Testing Strategies, Test Automation of Applications.	22 Hours
<u>Part B</u> **Mobile Operating System --**Introduction to Mobile Operating Systems and why they are needed, Open Platforms, Mobile OS Features, Symbian, BlackBerry, Android, iOS, Windows, Tizen, Ubuntu, etc. **Android programming:**Android toolkit, Components of an Android application, Android Software Development using Eclipse – Concepts, Terminology, Views and Perspectives, memory management, communication protocols, application development methods, deployment. **IOS:**Development environment, iOS Layers, Architecture, User Interface tool kit interfaces, Event handling, Graphics services, Layer Animation,BasiciPhone Styling, Advanced iPhone Styling.	22 Hours

Text 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.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.
2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.

3. Neal Goldstein, Tony Bove, “iPhone Application Development All-In-One For Dummies”, John Wiley & Sons.
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Course Code: PGCA1934
Course Name: Mobile Application Development Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Elective-II
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 how to work with various mobile application development frameworks.
CO2	Develop mobile applications using GUI and Layouts
CO3	Learn the basic and important design concepts and issues of development of mobile applications.
CO4	Analyze and discover own mobile app for simple needs.

List of Assignments	
Sr. No.	**Assignments**
1	Using emulator to deploy and run mobile apps
2	Create an Android application that shows Hello + name of the user and run it on an emulator.
3	Create an application that takes the name from a text box and shows hello message along with the name entered in text box, when the user clicks the OK button.
4	Develop an ANDRIOD application that uses GUI components, Font and Colors.
5	Write an application that draws basic graphical primitives on the screen.
	Develop an application that uses Layout Managers and event listeners.
7	Create and Login application as above. On successful login, open browser with any URL.
8	Testing mobile app - unit testing, black box testing and test automation.

9	Create an iOS application that can play audio and video files.
10	Write an iOS application that creates alarm clock.
11	Devise an iOS application that draws basic graphical primitives (rectangle, circle) on the screen.
12	Build an iOS mobile application that create, save, update and delete data in a database.

Text 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.

Reference Books:

1. ZigurdMednieks, L. Dornin, G. Blake Meike, M. Nakamura," Programming Andriod, 1st Edition, O'Relly Publication, 2011.
2. A. Allan" Learning iPhone Programming", 1st Edition, O'Relly Publication, 2010.
3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons.
4. Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS.

Course Code: PGCA1935
Course Name: Simulation & Modelling

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-II
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	Identify the paradigms and approaches used to design the simulation.
CO2	Understand the various types of simulation, techniques and methods.

CO3	Apply concepts of computer simulation for types of inputs, system models, output behavior and performance estimation
CO4	Test the goodness of a simulation by analyzing the simulated data.

Detailed contents	Contact hours
<u>Part A</u> **Inventory Concept:** The technique of Simulation, Major application areas, concept of a System, Environment, Continuous and discrete systems, systems modeling types of models progress of a Simulation Study, Monte Carlo Method, Comparison of Simulation and Analytical Methods. Numerical Computation Technique for discrete and continuous models, Continuous System Simulation. **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 Simulation inputs: Chi-Square and Chi-Square with Equal Probabilities, Kolmogorov-Smirnov Tests, pValues 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. **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.	26 Hours
<u>Part B</u> **Simulation of Queuing Systems:** Rudiments of queuing theory, Simulation of single-server queue, Simulation of two-server queue. **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. **Simulation Languages:** Basic Introduction to Special Simulation Languages:-GPSS/ MATLAB/ Network Simulators.	18 Hours

Text Books:

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. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.
3. Neal Goldstein, Tony Bove, "iPhone Application Development All-In-One For Dummies", John Wiley & Sons. Bhat, U. Narayan, An Introduction to Queueing Theory: Modeling and Analysis in Applications, Springer 2008 (Birkhäuser Boston).
4. James J. Nutaro, Building software for simulation: theory and algorithms, with applications in C++. Wiley, 2010.

Course Code: PGCA1936
Course Name: Simulation & Modelling Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Elective-II
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 use of software tools for modelling and analysis of mathematical concepts for engineering application.
CO2	Know how to simulate any discrete system using queuing systems.
CO3	Model and analyze simple engineering concepts and its importance in engineering applications.
CO4	Develop skills to apply simulation software to construct and execute goal-driven system models.

Sr. No.	Assignments

1	Installation of MATLAB.
2	Write a program in MATLAB using different types of branching statements.
3	Write a program to perform basic matrix operations.
4	WAP to plot different types of graphs in MATLAB.
5	Write a MATLAB code to plot with the elements of its vector representation
6	Programs on simulation of real time systems for automation purpose.
7	Simulation of continuous and discrete systems.
8	Programs on testing the random number set for uniformity and independence – Kolmogorov-Smirnov test, Chisquare test, Runs test and Autocorrelation test.
9	Programs on simulation of single and two-server queuing systems..
10	Programs on simulation of an inventory system.

Text Books:

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. Gordon, G: System Simulation, Prentice-Hall; 2 edition (1979).

Reference Books:

1. Gabriel A. Wainer, Discrete-event modeling and simulation: a practitioner's approach, CRC Press, 2009
2. Bernard P. Zeigler, Herbert Praehofer, Tag Gon Kim, Theory of modeling and simulation: integrating discrete event and continuous complex dynamic systems, Academic Press, 2000.

Course Code: PGCA1921
Course Name: E-Commerce & Digital Marketing

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-II
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 various applications and scope of ecommerce.
CO2	Acquire knowledge of various payment modes used in ecommerce today.

CO3	Learn to develop, evaluate, and execute a comprehensive digital marketing strategy and plan
CO4	Describe how and why to use digital marketing for multiple goals within a larger marketing and/or media strategy, Developing effective digital and social media strategies
CO5	Understand the major digital marketing channels - online advertising: Digital display, video, mobile, search engine, and social media

Detailed contents	**Contact hours**
<u>Part A</u> Introduction to Electronic Commerce: Technical Components of E-commerce, E-Commerce Framework, E-Commerce Applications and Electronic Business. Internet Service provider and World wide web. Architectural Framework for Electronic Commerce, WWW as the Architecture and Hypertext publishing. Electronic payment System : Types and Traditional payment, Value exchange system, Electronic funds transfer, Digital Token Based Electronic Payment System, Smart Cards – Credit Cards, Risk in Electronic Payment Systems, Designing Electronic Payment Systems. Electronic Data Interchange : Concepts and applications of EDI and Limitation. EDI and Electronic Commerce standardization and EDI – EDI Software Implementation. EDI Applications in Business – EDI: Legal, Security and Privacy issues.E- Governance for India : Indian customer EDI system and Service centres.	22 Hours
<u>Part B</u> Introduction to Digital Marketing : Components of Online Marketing (Email, Forum, Social network, Banner, Blog) , Impact of Online Marketing, Basics of Affiliate Marketing, Viral Marketing, Influencer Marketing, Referral Marketing, Online Advertising, Mobile Marketing, Web analytics and Email Marketing. Search Engine Optimization (SEO) and Social Engine Marketing (SEM).: Importance of Internet and Search Engine and Role of Keywords in SEO, On-Page Optimization (Onsite) and Off Page Optimization. Introduction to Social Media Marketing (SMM). Website Planning & Creation : Content Marketing Strategy, Keywords Research and Analysis, Web Presence and Creating content. Successful content marketing strategies and case studies.	22 Hours

Text Books:

4. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
5. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
6. Damian Ryan, Calvin Jone. Kogan Page; "Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation".

Reference Books:

1. Seema Gupta, Digital Marketing, McGraw Hill
2. Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
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.
4. Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
5. Venakataramana Rolla, "Digital Marketing Practice guide for SMB: SEO, SEM and SMM", CreateSpace Independent Publishing Platform, First edition.

Course Code: PGCA 1955

Course Name: e-Commerce and Digital Marketing Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 3rd	**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:** Elective-II

Prerequisite: --

Co requisite: --

Additional material required in ESE:--

Course Outcomes: After studying this course, students will be able to:

CO#	**Course Outcomes**
CO1	Understand of implementation of ecommerce applications.
CO2	Learn to develop and implement digital marketing strategy and plan
CO3	Implement and developing effective digital and social media strategies
CO4	Implementation and working on the social, and security issues concerning the digital marketing and e-commerce.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

Develop Strategy/ Case Study for a Company/ Website enhancing its Online visibility using following tools/channels:

1.	Social media marketing and optimization
2.	YouTube Marketing

3.	Facebook marketing
4.	Email marketing
5.	LinkedIn
6.	Twitter
7.	Google Analytics
8.	Mobile Advertising
9.	Content Marketing: Optimize customer and user experience
10.	Creating & publishing Blogs

Text Books:

7. Whitley, David, "E-Commerce Strategy, Technologies and Applications", Tata McGraw Hill.
8. Laudon and Traver, "E-Commerce: Business, Technology & Society", Pearson Education
9. Seema Gupta, "Digital Marketing", McGraw Hill
10. Puneet Singh Bhatia, "Fundamentals of Digital Marketing", Pearson.
11. 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.

Course Code: PGCA1931

Course Name: Software Testing & Quality Assurance

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 3rd	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 70	**Elective status:** Elective-II
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)

Co requisite: -NA-

Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand various approaches of software testing and quality assurance for software development.
CO2	Create test strategies, design test cases, prioritize and execute them.
CO3	Identify various risks involved with software projects and build risk management
CO4	Plan and execute software management and configuration activities.

Detailed contents	Contact hours
<u>Part A</u> **Software Testing:** Testing, Verification and Validation, Test Strategies for Conventional andObject Oriented Software, Unit Testing, Integration Testing, Validation Testing, Alpha andBeta Testing, System Testing,	26 Hours

Recovery Testing, Security Testing, Stress Testing,Performance Testing, Metrics for Source Code, Metrics for Testing, Debugging Process, Debugging Strategies. **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 BasedTesting Methods, Equivalence Partitioning, **Object Oriented Testing Methods:** Applicabilityof Conventional Test Case Design Methods, Issues in Object Oriented Testing, Fault-BasedTesting, Scenario-Based Testing, Random Testing and Partition Testing for Classes,InterClass Test Case Design. **Testing Process and Specialized Systems Testing:** Test Plan Development, RequirementPhase, Design Phase and Program Phase Testing, Testing Client/Server Systems, TestingWeb based Systems, Testing Offthe-Shelf Software, Testing in Multiplatform Environment,Testing for Real Time Systems, Testing Security.	
Part B **Software Quality Assurance Concepts and Standards:** Quality Concepts, Quality Control,Software Quality Attributes, Quality Assurance, SQA Activities, Software Reviews, Formal Technical Reviews, ReviewGuidelines, Software Reliability, Software Safety, Quality Assurance Standards, ISO 9000,ISO 9001:2000, ISO 9126 Quality Factors, CMM, CMMI, PCMM, TQM, Six Sigma, SPICE, Software Quality Assurance Metrics. **Risk Management and Change Management:** Software Risks, Risk Identification, RiskProjection, 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.	18 Hours

Text Books:

1. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
2. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

1. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
2. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
3. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: PGCA1956
Course Name: Software Testing & Quality Assurance Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):** 3 hrs
External max. marks: 30	**Elective status:** Elective-II
Total marks: 100	

Prerequisite: Software Engineering (PGCA1912)
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand various approaches of software testing and quality assurance for software development.
CO2	Create test strategies, design test cases, prioritize and execute them.
CO3	Identify various risks involved with software projects and build risk management
CO4	Plan and execute software management and configuration activities.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

1.	Introduction to Test Cases, How to create a simple test case and record it in the excel file.
2.	Developing Login functionality and testing them manually and storing the data in the sheet.
3.	Testing the registration functionality
4.	Testing flight reservation system and recording test cases
5.	Testing the date field scenario programmatically and recording test cases.
6.	Taking scenario of product description functionality in ecommerce website.
7.	Taking a scenario of payment functionality and order history in ecommerce website.
8.	Practicing the data flow testing taking some another logic and implying path testing
9.	Taking up path testing
10.	Developing a logical code to test boundary value exemptions
11.	Create an image upload functionality and make their test cases

12.	Teams will make HTML CSS design templates in hours and perform load and performance testing
13.	Developing applications to automate basis path testing.
14.	Exposure to automated testing tools such as Rational test manager,Selennium,Loadrunner or any other similar tools

Text Books:

3. Software Quality Assurance – From Theory to Implementation, Daniel Galin, Pearson Education
4. Software Testing Techniques, Boris Beizer, Dream Tech Press.

Reference Books:

4. Roger S. Pressman, Software Engineering, 8/e, McGraw Hill, 2014.
5. Effective Methods for Software Testing, Third edition, William E. Perry, Wiley India.
6. Software Testing – Principles and Practices, Naresh Chauhan, Oxford University Press Walker Royce, Software Project Management: A Unified Frame Work, Pearson Education.

Course Code: PGCA1976

Course Name: Machine Learning and Data Analytics using Python

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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	Learn Machine Learning concepts
CO2	Understand the difference between supervised and unsupervised learning
CO3	Learn clustering and classification algorithms
CO4	Analyse data using Python Numpy, Panda Libraries
CO5	Visualize data using matplotlib library of Python

Detailed contents	Contact hours
Part A	22 Hours

Machine Learning: Introduction, supervised, unsupervised, reinforcement learning. **Regression:** Linear Regression, linear classification, logistic regression. **Clustering:** K nearest neighbour, decision trees, Random forest. **Classification:** Naïve Bayes, principal component analysis, Introduction to neural networks.	
<u>Part B</u> **Introduction to Python Programming:** Data types, operators, control structures, functions, modules. **Numpy:** Introduction to numpy, arrays, array indexing, operations **Pandas:** Introduction to pandas, series, group by, DataFrames, missing data, merging, joining, concatenating, operations, data input and output. **Matplotlib**: Plotting, markers, line, labels, grid, subplot, scatter, bars, histograms, pie charts.	22 Hours

Text Books:

1. Machine Learning using Python, M Pradhan, U Dinesh Kumar, Wiley, 2015.
2. Introduction to Machine Learning with Python: A Guide for Dta Scientists, Andreas Muller, O'Reilly, 2016.
3. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, Willian Mckinney, O'Reilly, 2017.

Reference Books:

1. Machine Learning Applications Using Python: Cases Studies from Healthcare, Retail, and Finance, Puneet Mathur, Apress, 2019.
2. Python for Data Science For Dummies, John Paul, Luca, Massron, Wiley, 2019.

Course Code: PGCA 1958

Course Name: Advanced Web Technologies

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**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 client-side and server-side programming.
CO2	Learn to represent web data and XML document handling.
CO3	Understand AJAX and relevance.
CO4	Develop a dynamic webpage by the use of java PHP and MySQL.
CO5	Able to learn how to perform basic CRUD database operations in a Dynamic Website.
CO6	Learn about web services and their development.

Detailed contents	Contact hours
Part A **PHP**: Server-side web scripting, Installing PHP, Adding PHP to HTML, Syntax and Variables, Passing information between pages, Strings, Arrays and Array Functions, Numbers, Basic PHP errors/ problems. **Advanced PHP and MySQL**: PHP/MySQL Functions, Displaying queries in tables, Introduction to PHP OOPs concepts, Building Forms from queries, String and Regular Expressions, Sessions, Cookies and HTTP, Type and Type Conversions, E-Mail **Introduction to Web Services:** Use of Web Services, Types of Web Services, Introduction to Content Management System CMS (Types, Usages, Benefits).	22 Hours
Part B **XML**: Introduction to XML, XML Basics, XML Syntax and Editors, documents, Elements, Attributes. Creating XML documents. **Ajax** : Introduction and Use of Ajax in Website. **jQuery** : Introduction, jQuery UI: Date picker, auto complete, tooltip, accordion, retrieving page content, manipulating page content, working with events. **Introduction to Bootstrap :** Components of Bootstrap **Introduction to Node.js**: Node Package Manager (NPM), Node.js Webserver – Server and Clients. **React**: Introduction to ReactJS, Environment Setup, JSX, Components, State, Props, Validating Props, Component API, Component Life Cycle, Forms, Events	22 Hours

Text Books:

4. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
5. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
6. W. Jason Gilmore,"Beginning PHP and MySQL: From Novice to Professional", Apress.
7. "Learning PHP, MySQL, JavaScript, CSS and HTML 5", Robin Nixon, O'Reilly publication
8. Web Technologies, Black Book, dreamtech Press
9. Alex Young, "Node.js in Action", 2ed, Bradley Meck

Reference Books:

1. Jesus Caspagnetto, "Professional PHP Programming", Wrox Publication.
2. P.J. Deitel & H.M. Deitel, "Internet and World Wide Web How to program", Pearson
3. Harwani, "Developing Web Applications in PHP and AJAX", McGrawHill
4. Ralph Moseley and M. T. Savaliya, "Developing Web Applications", Wiley-India
5. HTML 5, Black Book, Dreamtech Press

Course Code: PGCA1977

Course Name: Machine Learning and Data Analytics using Python Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**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	Develop knowledge of various learning models of data.
CO2	Implement a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Instructions:

1. **Students may develop the assignments in Python.**
2. **Standard data sets or assumed data sets may be used for developing ML programs.**

Assignments:

1.	Design and evaluate a data model using Linear Regression.

2.	Design and evaluate a data model using Logistic Regression.
3.	Design and evaluate a data model using KNN.
4.	Design and evaluate a data model using K Means Clustering.
5.	Design and evaluate a data model using SVM.
6.	Design and evaluate a data model using PCA.
7.	Design and evaluate a data model using Decision Trees.
8.	Design and evaluate a data model using Random Forest.
9.	Compare the performance of all the above ML techniques on a similar data set using matplotlib.

Reference Books:

1. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
2. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: PGCA 1960
Course Name: Advanced Web Technologies Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**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: --
Co requisite: --
Additional material required in ESE:

- Install the following on local machine
  - Apache web server OR Tomcat application server locally
  - Install MySQL
  - PHP and configure it to work with Apache web server and MySQL

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Understand the advance concepts of website development.
CO2	Provide skills to design and develop dynamic web sites.
CO3	Work independently for database programming for web applications
CO4	Understand concepts of jQuery methods, AJAX, Bootstrap and REACT
CO5	Connect Website with an Database Server and perform basic CRUD operations.
CO6	Develop market ready website, to be used by clients.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments: All the Practical Assignments need to be carried on specific applications. (Example: Inventory Management System, Bus/Airline/Railway Reservation System, Student Management System etc.)

Practice Programs with PHP	
26.	PHP Code to display today's date in dd-mm-yyyy format.
27.	PHP Code to check if number is prime or not.
28.	PHP Code to print first 10 Fibonacci Numbers.
29.	PHP Code to read data from txt file and display it in html table (the file contains info in format Name: Password: Email)
30.	PHP Script for login authentication. Design an HTML form which takes username and password from user and validate against stored username and password in file.
31.	PHP Script for storing and retrieving user information from MySql table. • Design A HTML page which takes Name, Address, Email and Mobile No. From user (register.php) • Store this data in MySql database / text file. • Next page display all user in html table using PHP (display.php)
32.	PHP Script for user authentication using PHP-MYSQL. Use session for storing username.
Implement the following with specific web applications	
33.	Create HTML page for chosen application that contain textbox, submit / reset button. Write php program to display this information and also store into text file.
34.	Create XML documents for chosen application and validate using DTD and schema. Also render the content of XML document using XSL. Scenarios include • XML document must have attributes and elements so that they can be validated against DTD/Schema. • Check the data types of variables declared in XML document using Schema. • Display the details of data contained in XML document in a table using XSL.
35.	Embed the JQuery features for the application chosen. Perform the Scenarios using JQUERY ready function • In login form, define username and password constraints and ensure that the credentials follow them. • In registration form, username must be of atleast 6 characters. Password must be of atleast 8 characters and follow password constraints. Password and confirm password fields must match with each other. E-mail id must be of the form "yourname@domain.com". Mobile number must be of 10 digits only and starting digit must be any number from 6-9 etc… • Use the get and post methods for server side communication.
36.	Modify the specific web applications to use AJAX to show the result on the same page.
37.	Enhance functionality of the specific web applications using BOOTSTRAP
38.	Create a responsive Photo Gallery in BOOTSTRAP
39.	Suppose you have a list of Students having Student's Name, Roll Number, Marks in five subjects, Show this list in a responsive table in BOOTSTRAP
40.	Modify your answer for above question with PHP and MYSQL database and Perform CRUD operations with AJAX

41.	Build a Password Strength Check App with JQuery. You can use AJAX for form validation and add an alert when the user enters a weak password.
42.	Build a Registration Form and Validate it with JQuery. Registration Form must have at least 10 elements.
43.	Design a Sign In, Sign Up and Forgot Password Page with BOOTSTRAP. Use PHP and MYSQL to store Sign Up data in Database.
44.	Create a Star Rating System in JQuery.
45.	Create a simple To-do list Application with REACT
46.	Create a Calculator with REACT
47.	Create a Photo Gallery with REACT. Also implement search operation
48.	How can you create a Portfolio App with Node.js?
49.	Create a simple Shopping Cart with REACT and Node.js
50.	Modify your Shipping Cart with JQuery, JSON and AJAX functionality.

Reference Books:

10. Roger S Pressman, David Lowe, "Web Engineering: A Practitioner's Approach", TMH.
11. Steven Holzner, "PHP: The Complete Reference", TATA McGraw Hill, 2015.
12. W. Jason Gilmore,"Beginning PHP and MySQL: From Novice to Professional", Apress.
13. Learning PHP, MySQL, JavaScript, CSS and HTML 5, Robin Nixon, O'Reilly publication

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Course Code: PGCA1937
Course Name: Cloud Computing

Program: MCA	**L:**4 **T:**0 **P:**0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems:**
Internal max. marks: 30	**Duration of end semester exam (ESE):**
External max. marks:70	**Elective status: core/elective** Elective-III
Total marks:100	

Prerequisite:
Co requisite:
Additional material required in ESE:
Course Outcomes: Students will be able to

CO#	Course outcomes
CO1	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	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
Part A **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 Reference 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. **Virtualization:** Introduction, Characteristics of Virtualized environment, Taxonomy of Virtualization techniques, Virtualization and Cloud Computing, Pros and Cons of Virtualization, Technology Examples- Xen, VMware, Microsoft Hyper-V. **Capacity Planning:** Introduction, Defining Baseline and Metrics- Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.	22 hours
Part B **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. **Cloud Storage:** Provisioning Cloud Storage, Virtual storage containers, Cloud Storage Interoperability (CDMI, OCCI), Database Storage, Resource Management, **Advance Topics in Cloud:**Energy Efficiency in cloud, Market Oriented Cloud Computing, Federated Cloud Computing, Mobile Cloud Computing, Fog computing, BigData Analytics, Basics of IoT. **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.	22 hours

Text Books:

1. Mastering Cloud Computing, Rajkumar Buyya, Christian Vecchiola, and ThamaraiSelvi, 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, AndrezeiM.Goscinski, Wiley India Pvt. Ltd, ISBN-13: 978-81-265-4125-6,New Delhi, India, 2011

Reference Books:

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:PGCA 1938
Course Name: Cloud Computing Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE): -**
External max. marks: 30	**Elective status: core/elective** Elective-III
Total marks: 100	

Prerequisite: Working Knowledge of Linux Operating system
Co requisite:
Additional material required in ESE:
Course Outcomes: Students will be able to

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.

Sr. No.	Experiment Name
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.	Interact with Cloud Storage and conduct typical management tasks such as bucket creation, file transfers, Access Control Lists (ACL) permissions and Identity and Access Management (IAM) configuration.
6.	Setting up a private cloud using open source tools (Eucalyptus/Open Stack etc.).

Reference Books:

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.

Course Code: PGCA1963
Course Name: Digital Image Processing

Program: MCA	**L**:4 **T**:0 **P**:0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks:70	**Elective status:** Elective-III
Total marks: 100	

Prerequisite: -Student must have knowledge about Computer Graphics.
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: Students will be able to:

CO#	Course outcomes
CO1	Understand the need for various image transforms along with properties
CO2	Learn different techniques employed for the enhancement of images
CO3	Understand the rapid advances in Machine vision
CO4	Analyze images in multiresolution environment
CO5	Learn image compression techniques

Detailed contents	Contact hours
Part A **Introduction:** Fundamental steps in Digital Image Processing, Components of an image processing system, Image sampling and quantization, Color models	24 Hours

Digital Image Processing Operations: Pixel relationships and distance metrics - Image coordinate system, Image topology, Connectivity, Relations, Distance measures. Classification of image processing Operations - Arithmetic, Logical, Geometrical (Translation, Scaling, Zooming, Linear Interpolation, Mirror or Reflection, Shearing, Rotation, Affine and Inverse transformation) Operations, Image interpolation Techniques (Downsampling and upsampling), Set operations, Statistical operations, Convolution and Correlation operations. **Image Enhancement in Spatial Domain:** Image enhancement point operations-Linear and non-linear functions, Piecewise linear functions, Histogram processing. Spatial filtering - basics of filtering in the spatial domain, Vector representation, Smoothing linear and non-linear filters, sharpening filters. **Image Enhancement in Frequency Domain:** Basics of filtering in the frequency domain, Image smoothing and sharpening using frequency domain filters.	
Part B **Image Restoration:** A model of the image degradation/restoration process, Noise models, Noise filters, Degradation function. **Multiresolution Analysis:** Wavelet analysis, Continuous wavelet transform, Discrete wavelet transform, Wavelet decomposition and reconstruction in two dimensions, Wavelet packet analysis, Wavelet based image denoising. **Image Compression:** Image compression model, Compression measures, Compression algorithm and its types (Entropy, Predictive, Transform and layered coding), Types of redundancy (Coding, Inter-pixel, Psycho-visual and Chromatic), Lossless compression algorithms – Run-length, Huffman, Bit-plane, Arithmetic, Predictive coding. Lossy compression algorithms – Lossy predictive, Block transform coding. **Image Segmentation:** Classification of image segmentation algorithms, Point, Line and Edge detection, Hough transforms, Corner detection, Global thresholding, Otsu's method, Multivariable thresholding, Region-based segmentation, Watershed segmentation,	20 Hours

Text Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.

2. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011.

Reference Books:

1. M. Sonka, V. Hlavac and Roger Boyle, " Image Processing, Analysis and Machine Vision", Thomas Learning, 2007

2. K. R. Castleman, "Digital Signal Processing", Pearson Education, 2007.

Course Code: PGCA1964

Course Name: Digital Image Processing Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**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:** Elective-III

Prerequisite: Students must have the knowledge of computer graphics.

Course Outcomes: After studying this course, students will be able to:

CO#	Course Outcomes
CO1	Implement the various operations which can be performed on images.
CO2	Apply filters on images as per the requirement
CO3	Implement different techniques employed for the enhancement of images
CO4	Develop an Image Processing Application

Instructions: For implementation, software such as Python/SciLab/MATLAB or any other image processing software can be used and instructor may increase/decrease the experiments as per the requirement.

Sr no.	Assignments
51.	Installation of image processing software and use of basic image processing commands.
52.	Generation of lines, array, matrix and image
53.	Reading and displaying images in different formats using different color models
54.	Converting color images into monochrome images
55.	Displaying of image Histogram
56.	Image color enhancements using pseudo coloring techniques
57.	Image restoration techniques.
58.	Application of image processing operations
59.	Point, Line, and Edge Detections in images
60.	Boundary Detections in images
61.	Color image processing
62.	Wavelet transforms.
63.	Image compression techniques
64.	A minor project based on above taught image processing techniques.

Reference Books:

1. R. C. Gonzalez and R. E. Woods, "Digital Image Processing", Pearson Education, 2013.

Course Code: PGCA1965
Course Name: NLP and Speech Recognition

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks: 30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-III
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	Learn basics of natural language processing
CO2	Understand the text normalization, use of edit distance, and regular expressions
CO3	Learn Naive bayes and sentiment classification algorithms
CO4	Familiarize with chatbots and phonetics
CO5	Learn the concept of speech recognition and text to speech conversion.

Detailed contents	Contact hours
Part A **Introduction to Natural Language Processing** **Regular Expressions, Text Normalization, Edit Distance:** Regular Expressions, Words, Corpora, Text Normalization, Minimum Edit Distance **N-gram Language Models:** N-Grams, Evaluating Language Models, Generalization and Zeros, Smoothing, Kneser-Ney Smoothing, Huge Language Models and Stupid Backoff, Advanced: Perplexity's Relation to Entropy **Naive Bayes and Sentiment Classification:** Naive Bayes Classifiers, Training the Naive Bayes Classifier, Optimizing for Sentiment Analysis, Naive Bayes for other text classification tasks, Naive Bayes as a Language Model, Evaluation: Precision, Recall, F-measure, Test sets and Cross-validation, Statistical Significance Testing, Avoiding Harms in Classification **Logistic Regression:** Classification: the sigmoid, Learning in Logistic Regression, The cross-entropy loss function, Gradient Descent,	22 Hours

Regularization, Multinomial logistic regression, Interpreting models, Advanced: Deriving the Gradient Equation	
Part B **Chatbots & Dialogue Systems:** Properties of Human Conversation, Chatbots, GUS: Simple Frame-based Dialogue Systems, The Dialogue-State Architecture, Evaluating Dialogue Systems, Dialogue System Design **Phonetics:** Speech Sounds and Phonetic Transcription, Contents, Articulatory Phonetics, Prosody, Acoustic Phonetics and Signals, Phonetic Resources **Automatic Speech Recognition and Text-to-Speech:** The Automatic Speech Recognition Task, Feature Extraction for ASR: Log Mel Spectrum, Speech Recognition Architecture, CTC, ASR Evaluation: Word Error Rate, TTS, Other Speech Tasks	22 Hours

Text Books:

14. Speech and Language Processing, An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition, Daniel Jurafsky, James H. Martin, Pearson, 2020
15. The Oxford Handbook of Computational Linguistic, Ruslan Mitkov, Oxford
16. Taming Text, Grant Ingersoll, Thomas Morton and Drew Farris, Manning

Reference Books:

3. Natural Language Processing with Python by Steven Bird, Ewan Klein and Edward Loper, O'Reilly, 2009

Course Code: PGCA1966
Course Name: NLP and Speech Recognition Laboratory

Program: MCA	**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: 70	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 30	**Elective status:** Elective-III
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	Develop knowledge of various learning models of data.
CO2	Understand a wide variety of learning algorithms.
CO3	Understand how to evaluate models generated from data.
CO4	Apply the algorithms to a real-world problems.
CO5	Optimize the models learned and report on the expected accuracy that can be achieved by applying the models.

Instructions:

3. **Students may develop the assignments in Python.**
4. **Standard data sets or assumed data sets may be used for developing ML programs.**

Assignments:

10.	Write a Program for Word Analysis.
11.	Write a Program for Word Generation.
12.	Write a program to implement Morphology.
13.	Write a Program to implement N-Grams.
14.	Write a Program to implement N-Grams Smoothing.
15.	Write a Program to implement POS Tagging: Hidden Markov Model.
16.	Write a Program to implement POS Tagging: Viterbi Decoding
17.	Design and evaluate a data model using Linear Regression.
18.	Design and evaluate a data model using Logistic Regression.
19.	Design a vocabulary of about 20 words. Choose words with a variety of segmental structure and length: place names or animal names for example. Add in a few minimal pairs.

Reference Books:

3. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C. Müller, Sarah Guido, O'Reilly Media.
4. Understanding Machine Learning: From Theory to Algorithms, Shai Shalev-Shwartz, Shai Ben-David, Cambridge University, Press.

Course Code: PGCA1967

Course Name: IOT & Blockchain Technology

Program: MCA	**L**: 4 **T**: 0 **P**: 0
Branch: Computer Applications	**Credits:** 4
Semester: 4th	**Contact hours:** 44 hours
Theory/Practical: Theory	**Percentage of numerical/design problems: --**
Internal max. marks:30	**Duration of end semester exam (ESE):** 3hrs
External max. marks: 70	**Elective status:** Elective-III
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 terminology and enabling technologies of IoT and Blockchain
CO2	Enumerate the steps involved in IoT system design methodology
CO3	Gain Knowledge about the working of bit coin crypto currency
CO4	Describe domain specific applications of IoT and Blockchain

Detailed contents	Contact hours
Part A **Introduction to Internet of Things (IoT):** Definitions & Characteristics of IoT, Physical Design of IoT-Things in IoT, Protocols, Logical Design of Functional Blocks, Communication Models, Communication APIs. **Enabling Technologies:** Wireless Sensor Networks, Cloud Computing, Big Data Analytics, Communication Protocols, Embedded Systems, IoT Levels & Deployment Templates. **Elements of IoT :** Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces. Software Components- familiarity with API's for Communication, Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP. Solution Framework for IoT applications. **Domain Specific IoTs**: IoT applications for Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle	24 Hours
Part B **Concept of Blockchain**: Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain **Bitcoin and Blockchain**: Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin	20 Hours

Network, Block Mining, Block propagation and block relay. **Enterprise Application of Blockchain**: Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade — Trade Finance Network, Supply Chain Financing, Identity on Blockchain	

Text Books:

5. Arshdeep Bahga, Vijay Madisetti, "Internet of Things-A Hands-on Approach", Universities Press, 2015.
6. Melanie Swan, "Blockchain: Blueprint for a New Economy", O'Reilly, 2015.
7. Andreas Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly, 2014.

Reference Books:

1. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press).
2. Raj Kamal, "Internet of Things: Architecture and Design", McGraw Hill
3. Cuno Pfister, "Getting Started with the Internet of Things", O Reilly Media.
4. Iran Bashir "Mastering Blockchain", Second Edition Paperback, 2018.
5. Daniel Drescher, "Blockchain Basics", First Edition, Apress, 2017.

Course Code: PGCA1968
Course Name: IOT & Blockchain Technology Laboratory

Program: MCA	**L**: 0 **T**: 0 **P**: 4
Branch: Computer Applications	**Credits**: 2
Semester: 4th	**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:** Elective-III

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Course Outcomes: After studying this course, students will be able to:

CO#	**Course Outcomes**
CO1	Learn and Use IoT sensors and remotely monitor data and control devices.
CO2	Develop real life IoT based projects.
CO3	Understand blockchain technology and develop blockchain based solutions.
CO4	Build and deploy IoT based blockchain applications for on-premise and cloud based architecture.

Instructions: Instructor can increase/decrease the experiments as per the requirement.

Assignments:

65.	Familiarization with Arduino/Raspberry Pi and perform necessary software installation.

66.	To interface LED/Buzzer with Arduino/Raspberry Pi and write a program to turn ON LED for 1 sec after every 2 seconds.
67.	Interfacing Rain Sensing Automatic Wiper System
68.	To interface DHT11 sensor with Arduino/Raspberry Pi and write a program to print temperature and humidity readings.
69.	To interface motor using relay with Arduino/Raspberry Pi and write a program to turn ON motor when push button is pressed.
70.	To interface Bluetooth with Arduino/Raspberry Pi and write a program to send sensor data to smartphone using Bluetooth.
71.	Write a program on Arduino/Raspberry Pi to upload and retrieve temperature and humidity data to and from thingspeak cloud.
72.	Interfacing smoke sensor to give alert message to fire department.
73.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric/ Ethereum and perform necessary software installation on local machine/create instance on cloud to run.
74.	Create and deploy a blockchain network using Hyperledger Fabric SDK/Ethereum for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.
75.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.
76.	Develop an IOT asset tracking app using Blockchain. Use an IOT asset tracking device to improve a supply chain by using Blockchain, IOT devices and Node-RED

e-Resources:

1. GitHub repository.
2. IBM library for IoT.

Course Code: PGCA1961
Course Name: Research/Technical seminar

Program: MCA	**L**: 0 **T**: 0 **P**: 2
Branch: Computer Applications	**Credits**: 1
Semester: 4th	**Contact hours:** 2 hours per week
Internal max. marks: 0	**Theory/Practical**: Practical
External max. marks: 100	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 100	**Elective status:**

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Project:

Students may be encouraged to take up internship projects in industry or research/academic institutions.

Students may be offered software/hardware development or research oriented projects if taken in house.

Faculty members may offer project proposals from their side and students may choose from them.

Students may also submit project proposals not covered in the faculty provided list, which may be guided by the interested faculty members.

Co-guidance with external institutes/industry may also be allowed.

Same project ideas may be submitted by more than one student group, but may be unique at the implementation level, as per the judgment of the department.

Students may be encouraged to take up more innovative projects involving contemporary technologies, leading to research paper and/or patent publications.

Minor Projects from the previous semester may also be carrying forwarded with significant up gradations.

Technical seminar:

Industry seminars are suggested to enable the students of MCA to appreciate the software developments which are going on in industries in India. These seminars will help the students to face interviews with some confidence. The students should attend these and submit a report. The following points are listed to enable the college to organize these seminars.

1. Three to four organizations (Industry, Public sector organizations, Govt. organizations) are requested to present a detailed case study of one or many applications in their organization.

2. Presentation covers in detail all aspects of a project from conception to implementation and maintenance. Design is discussed to cover all factor that influenced the design. Planned and achieved benefits of the application are also stressed.

3. In order that the students take the presentations seriously, groups of students are assigned to prepare a detailed synopsis of each presentation, copies of which are distributed to others.

4. One session could be a survey of new applications in the Indian environment during the past year, as ascertained from a survey of news paper articles. This is to be done by a group of students.

5. College can invite potential employers to participate in the inauguration- and valediction of the seminar so that the efforts of the college get noticed by employers.

6. It is neither necessary nor possible to have an examination on the seminar. Idea is that the motivated students get an opportunity to seek answers to questions on worthwhile computerization on our economy.

Course Code: PGCA1962
Course Name: Project

Program: MCA	**L**: 0 **T**: 0 **P**: 8
Branch: Computer Applications	**Credits**: 4
Semester: 4th	**Contact hours:** 8 hours per week
Internal max. marks: 180	**Theory/Practical**: Practical
External max. marks: 120	**Duration of End Semester Exam (ESE):** 3hrs
Total marks: 300	**Elective status:**

Prerequisite: - NA-
Co requisite: -NA-
Additional material required in ESE: -NA-

Annexure A

OBJECTIVE

The objective of the project course is to help the student develop ability to apply multi-disciplinary concepts, tools and techniques to analyze and logically approach the organizational problems.

PROJECT PROPOSAL EVALUATION:

The project proposal/Synopsis will be submitted within 2 weeks from start of semester and evaluated by the panel of three teachers in the presence of student, who will give the presentation to the panel.

In case of non-approval of the Synopsis the comments/suggestions for reformulating the Synopsis will be communicated to the student. In such case, the revised Synopsis should be submitted within 7 days, which shall be evaluated on similar guidelines.
Then after period of 1 Month Progress report 1 has been evaluated by Guide on the basis of following:

1. Problem Definition
2. Need & Scope of the Study
3. Methodology & Objectives
4. Data Analysis & Findings

Then after period of 2 Month Progress report 2 has been evaluated by Guide on the basis of following:

1. Testing & Implementations
2. Suggestions and Conclusions
3. Overall Report Writing & Layout

PROJECT PRE-SUBMISSION:

After approval of the Synopsis, student shall complete their projects and submit the completed Project Report (Spiral bound) for final internal evaluation before 2nd MST.

The guidelines for project report are as follows:

- The length of the report may be about 60 to 80 double spaced typed pages not exceeding approximately 18,000 words (excluding appendices and exhibits). However, rational variation on either side is permissible.
- The Project Report may have the following:
  - Cover Page – must have the Title of the Project, Name & logo of college / university, Name and University Roll No of the Student and the Name of the Guide, along with the designation and department.
  - Detailed table of contents with page nos.
  - All pages of the Project Report must be numbered as reflected in the table of contents.
  - Project Proposal, properly bound in the project and not just stapled. Please note that project with stapled Proposal will not be accepted.
  - Certificate of originality- duly signed by the student and the guide with dates.
  - Introduction to the Project and Review of Literature along with brief details of the organization/s understudy.
  - Rationale
  - Statement of problem
  - Objectives of the Project
  - Scope of the study
  - Research Methodology
    - Research Design
    - Nature and Source of data/information collected
    - Sample and Sampling method with rationale
  - Details of the tools:
    - The Questionnaire and other methods used and their purpose
    - Reliability and Validity of the tools used
    - Administration of tools and techniques
    - Data collection
    - Data Handling, Statistical tools used for Data Analysis
  - Data Interpretation and Findings
  - Recommendations
  - Summary and Conclusion
  - Limitations of the Project
  - Direction for further research (optional)
  - Reference/Bibliography
  - Annexures/Appendices (Questionnaire used etc.)
- Note: Research Methodology of the Project Report must have elaborate detail of all the components of the methodology.

The spiral bound project report will be evaluated by the panel of three teachers before second MST in presence of student, who will give the presentation to the panel before second MST.

In case of non-approval of the final project report, the comments/suggestions for revising the project report will be communicated to the student. In such case, the revised project report should be submitted within 7 days, which shall be evaluated on similar guidelines.

SUBMISSION OF FINAL PROJECT REPORT:

After incorporating changes, if any, pointed out during internal evaluation, the final Project Report in Hard Bound form (3 copies) shall be submitted by the student at least 3 working days before final viva voce. After signing of certificate by student and supervisor, one copy will be retained by the supervisor, second copy by the student and third copy shall be produced at the time of viva-voce, which shall be maintained by the department as record.

Note:

1. **Wherever it is felt that there is not sufficient time to complete the project after approval of Synopsis, the phases of Project till "Project Proposal Evaluation" may be completed in third semester at department level.**
2. **Minor Projects from the previous semester may also be carrying forwarded with significant up gradations with the consent of HOD.**
3. **For further details on references, bibliography and formatting of the report, you may refer the Guidelines for Project Report.**

EVALUATION CRITERIA FOR PROJECT REPORT (MCA-PGCA1962)

S.No.	Name	Roll No. & Date of Presentation	Synopsis	Problem Definition / Need & Scope of the Study	Methodology & Objectives	Data Analysis & Findings	Testing and Implementation	Suggestions & Conclusion	Overall Report Writing & Layout	Total Earned Marks out of (170)	Signature of the Evaluator with Date	Attendance Marks (in accordance to the criteria)	Total Earned Marks out of (180)
				Progress Report 1			**Progress Report 2**						
			60	**20**	**15**	**15**	**20**	**20**	**20**	**160**		**10**	**180**
1													
2													
3													

Note:

1) Total marks of "Project Report (MCA PGCA1962)" = 180
2) Attendance Marks (from a total of 5 marks) to be given on the basis of percentage of lectures attended of MCA during the academic term as per the following criteria:
   i. Above 75% = NIL
   ii. 76% - 80% = 1
   iii. 81% - 85% = 2
   iv. 86% - 90% = 3
   v. 91% - 95% = 4
   vi. 96% and above = 5

Guidelines for Project Report

Project Report on

"PROJECT TITLE"

Submitted to

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

KAPURTHALA

In partial fulfillment of the requirement for the

award of degree of

Master of Computer Applications (MCA)

Submitted by	**Supervisor**
Name of the Student	Name (Guide)
University Roll no.	Designation

Logo of the Institute

DEPARTMENT OF COMPUTER

APPLICATIONS

NAME OF THE INSTITUTE

NAME OF THE CITY

(Batch)

CERTIFICATE (On a Separate Page)

*Certificate of Project from Institute/Company/Industry shall be attached herewith.

STUDENT DECLARATION (On a Separate Page)

I, "_______________________________ (Student Name)", hereby declare that I have undergone my Project at " _____________________(Institute/Industry Name)" from __(start date) to ___(end date). I have completed a research project tilted "____________________________________ (Project Title)" under the guidance of Mr. /.Ms. ________________________(Name of Supervisor).

Further I hereby confirm that the work presented herein is genuine and original and has not been published elsewhere.

____

(Student name and Signature)

FACULTY DECLARATION (On a Separate Page)

I hereby declare that the student Mr. / Ms. _____________________________ of MCA has undergone his/her Project under my periodic guidance on the Project titled " (Project Title)".

Further I hereby declare that the student was periodically in touch with me during his/her training period and the work done by student is genuine & original.

____

(Signature of Supervisor)

ACKNOWLEDGEMENT (On a Separate Page)

*****Acknowledge the support and guidance provided to you by various persons during your Project Training

TABLE OF CONTENTS (On a Separate Page)

LIST OF TABLES

LIST OF FIGURES

General Guidelines for Layout and format

1. Paper Size must be A4 and margins should be maintained on all pages as follows: **Left margin = 1.5” (wider for binding) Top, right & bottom margins = 1”**
2. Use **Times New Roman** font, **12 point**size, for text. and **14 point** size for headings
3. Use **1.5 *line spacing***for all text in the main body of the thesis.
4. Report should contain page numbers (1, 2, 3….) starting from Introduction Chapter. Preliminary pages should be numbered: i., ii., iii, iv, v, vi, etc. A page number should not be shown on the inside title page even though it is counted as i.
5. Page number should be placed at the **bottom- center of page**.

Imp Note:

1. Students are required to prepare two Hard Bound copies of their Project report to be submitted within 10 days of commencement of 3rd Semester
2. Questionnaires in original to be retained by the students for the final presentation if required.

Guidelines on Faculty Guide-Student Interaction

1. The Student is required to be in constant touch with their Faculty Guide through email, telephone, personal interactions etc.
2. It is mandatory for the student to provide a weekly progress report to their Faculty Guides for each week of their Project.
3. The Topic for the Project should be chosen in consultation with their Faculty guide and after their due approval.
4. Same topics having any sort of duplicacy shall not be acceptable.
5. Institute will be conducting surprise visits of the organization where the Student is undergoing Project from time to time and any students found to be irregular / not attending their Project then the Project report of the said student shall stand cancelled .

Preparing References/Bibliography

- While preparing the Bibliography, in case of website as a source, ensure that the date and the timing of accessing the website is mentioned along with.
- While preparing bibliography student must adopt the following method:

Article in a Magazine

Henry, W. A., III. (1990, April 9). Making the grade in today's schools.*Time, 135*, 28-31.

Article in a Newspaper

Unlike other periodicals, p. or pp. precedes page numbers for a newspaper reference in APA style. Single pages take p., e.g.., p. B2; multiple pages take pp., e.g.., pp. B2, B4 or pp. C1, C3-C4.

Schultz, S. (2005, December 28). Calls made to strengthen state energy policies. *The Country Today*, pp. 1A, 2A.

Basic Format for Books

Author, A. A. (Year of publication).*Title of work: Capital letter also for subtitle*. Location: Publisher.

Note: For "Location," you should always list the city, but you should also include the state if the city is unfamiliar or if the city could be confused with one in another state.

Calfee, R. C., & Valencia, R. R. (1991).*APA guide to preparing manuscripts for journal publication*. Washington, DC: American Psychological Association.

Government Document

National Institute of Mental Health.(1990). *Clinical training in serious mental illness* (DHHS Publication No. ADM 90-1679). Washington, DC: U.S. Government Printing Office.

Report From a Private Organization

American Psychiatric Association. (2000). *Practice guidelines for the treatment of patients with eating disorders* (2nd ed.). Washington, D.C.: Author.

Conference Proceedings

Schnase, J.L., &Cunnius, E.L. (Eds.). (1995). Proceedings from CSCL '95: *The First International Conference on Computer Support for Collaborative Learning*. Mahwah, NJ: Erlbaum.

Article From an Online Periodical

Author, A. A., & Author, B. B. (Date of publication).Title of article.*Title of Online Periodical, volume number*(issue number if available). Retrieved month day, year, (if necessary) from http://www.someaddress.com/full/url/

Bernstein, M. (2002).10 tips on writing the living Web.*A List Apart: For People Who Make Websites, 149*. Retrieved May 2, 2006, from http://www.alistapart.com/articles/writeliving

Online Newspaper Article

Author, A. A. (Year, Month Day).Title of article.*Title of Newspaper*. Retrieved http://www.someaddress.com/full/url/

Parker-Pope, T. (2008, May 6). Psychiatry handbook linked to drug industry. *The New York Times*. Retrieved from http://www.nytimes.com

Electronic Books

De Huff, E.W. *Taytay's tales: Traditional Pueblo Indian tales*. Retrieved from http://digital.library.upenn.edu/women/dehuff/taytay/taytay.html

Davis, J. *Familiar birdsongs of the Northwest*. Available from http://www.powells.com/cgi-bin/biblio?inkey=1-9780931686108-0

Online Encyclopedias and Dictionaries

Feminism.(n.d.)In *Encyclopædia Britannica online*. Retrieved March 16, 2008, from http://www.britannica.com

Annexure B

Guidelines for Research/ Technical Seminar:

OBJECTIVE

The objective of the Research /Technical Seminar is to help the student develop ability to apply multi- disciplinary concepts, tools and techniques to analyze and logically approach the organizational problems.

The Research topic may be from any one of the following types, however, it should preferably be from your area of specialization in MCA:

i) Survey of Literature/Comprehensive case study (covering single organization/multifunctional area problem formulation, analysis and recommendations).
ii) Inter-organizational study aimed at inter-organizational comparison/validation of theory/survey of management practices.
iii) Field study / Conclusion (empirical study).

REPORT PROPOSAL

Proposal should be prepared in consultation with the supervisor and submitted before the routine first MST in department. The length of the report may be about 25 to 30 double spaced typed pages not exceeding approximately 5000 words (excluding appendices and exhibits). However, rational variation on either side is permissible.

The Proposal may have the following components:

a) Introduction, brief background, and Rationale of the topic chosen for the Research.
b) Brief Introduction and vital details of the organization/s understudy.
c) Statement of the Research problem.
d) Objectives of the Research (clearly stated in behavioral terms).
e) Research Methodology:
    - Research Design
    - Survey of Literature
    - Nature and source of data / information to be collected.
    - Sample and sampling technique. Rationale of chosen organization and the sample.
    - Tools and Techniques to be used for data collection – details of the tools/questionnaire to be used and its relevance with the objectives of the project.
    - Method/s to be used for data collection
    - Data handling and analysis
    - Statistical tools to be used for analysis
    - Conclusion.
f) Limitation of the proposed research work, if any.
g) Any other relevant detail which will help better appreciation and understanding of the research study.

EVALUATION CRITERIA FOR Research/Technical Seminar

S.N.	Name	Roll No. & Date of Presentation	Introduction & Review of Literature	Rationale, Problem Definition, Scope & Objectives	Research Methodology	Data Analysis & Findings	Suggestions & Conclusion &Scope for Future research	Overall Report Layout and Viva Performance	Total Earned Marks (out of 100)	Signature of the Evaluator with Date
			15	15	15	20	15	20	100	
1										
2										
3										

Name of Student: ....Roll No:
....

Research/ Technical Seminar
(Title)...

Estimated
duration..

Name of Organization &
Address...

....
..

....
..

Nature of
Research...
..

(Application/Network/Web based) Research Description (Additional Pages is to be attached to give description of the work under the following
heads)...
.

....
..

Features of the
Research...

Existing
Papers...

Proposed
Papers...
.

Tools..
....

Requirements: Hardware & Software
Requirements...
..

....
..

Signature of student (Signature of Guide In-charge)

Scheme of

Bachelor of Technology

Computer Science & Engineering

Batch 2018

(3rd - 8th Semester)

For University Campuses

By

Department of Academics

IK Gujral Punjab Technical University

Bachelor of Technology in Computer Science & Engineering

It is a Graduate (UG) Programme of 4 years duration (8 semesters)

Courses & Examination

Third Semester

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/Un satisfactory
Total			**14**	**1**	**12**	**320**	**380**	**700**	**21**

*Syllabus to be decided by respective institute internally. It may include latest technologies.

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**	**290**	**360**	**650**	**24**

Students will take up summer internship of 4-6 weeks at industry or organizations of repute after 4th sem, that will be accredited in 5th semester.

Fifth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
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	1	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
BTCS YYY-18	Professional Elective Courses	Elective-II	3	0	0	40	60	100	3
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
BTCS YYY-18	Professional Elective Courses	Elective-II lab	0	0	2	30	20	50	1
		Industrial Training	0	0	0	60	40	100	Satisfactory/Un satisfactory
Total			**18**	**1**	**12**	**450**	**500**	**950**	**24**

Sixth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS 601-18UC	Professional Core Courses	Compiler Design	3	0	0	40	60	100	3
BTCS 602-18UC	Professional Core Courses	Artificial Intelligence	3	1	0	40	60	100	3
BTCS ZZZ-18UC	Professional Elective Courses	Elective-III	3	0	0	40	60	100	3
BTCS UUU-18UC	Professional Elective Courses	Elective-IV	3	0	0	40	60	100	3
BTOE ***	Open Elective Courses	Open Elective-I	3	0	0	40	60	100	3
BTCS 603-18UC	Project	Project-1	0	0	6	60	40	100	3
BTCS 604-18UC	Professional Core Courses	Compiler Design Lab	0	0	2	30	20	50	1
BTCS 605-18UC	Professional Core Courses	Artificial Intelligence Lab	0	0	2	30	20	50	1
BTCS ZZZ-18UC	Professional Elective Courses	Elective-III Lab	0	0	2	30	20	50	1
BTCS UUU-18UC	Professional Elective Courses	Elective-IV Lab	0	0	2	30	20	50	1
Total			**15**	**0**	**14**	**380**	**420**	**800**	**22**

Seventh Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS VVV-18UC	Professional Elective	Elective-V	3	0	0	40	60	100	3
BTCS TTT-18UC	Professional Elective Courses	Elective-VI	3	0	0	40	60	100	3
BTOE ***	Open Elective Courses	Open Elective-II	3	0	0	40	60	100	3
BTOE ***	Open Elective Courses	Open Elective- III	3	0	0	40	60	100	3
BTCS 701-18UC	Professional Core Courses	Machine Learning	3	0	0	40	60	100	3
BTCS 702-18UC	Project	Project-II	0	0	12	120	80	200	6
BTCS 703-18UC	Professional Core Courses	Machine Learning Lab	0	0	2	30	20	50	1
BTCS VVV-18UC	Professional Elective	Elective-V lab	0	0	2	30	20	50	1
BTCS TTT-18UC	Professional Elective Courses	Elective-VI lab	0	0	2	30	20	50	1
Total			**15**	**0**	**18**	**410**	**440**	**850**	**24**

Eighth Semester

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
BTCS 801-18UC	Semester Training	300	200	500	16

LIST OF ELECTIVES

Elective-I

BTCS 508-18 Programming in Java
BTCS 509-18 Web and Open Source Technologies
BTCS 510-18 Programming in Python
BTCS 511-18 Programming in Java lab
BTCS 512-18 Web and Open Source Technologies lab
BTCS 513-18 Programming in Python Lab

Elective-II

BTCS 514-18 Mobile Application Development
BTCS 515-18 Computer Graphics
BTCS 516-18 Internet of Things
BTCS 517-18 Mobile Application Development lab
BTCS 518-18 Computer Graphics Lab
BTCS 519-18 Internet of Things Lab

Elective-III

BTCS 606-18UC Network Security and Cryptography
BTCS 607-18UC Data Mining
BTCS 608-18UC Cloud Computing
BTCS 609-18UC Network Security and Cryptography Lab
BTCS 610-18UC Data Mining lab
BTCS 611-18UC Cloud Computing lab

Elective-IV

BTCS 612-18UC Information Theory and Coding
BTCS 613-18UC Data Science
BTCS 614-18UC Soft Computing
BTCS 615-18UC Information Theory and Coding lab
BTCS 616-18UC Data Science Lab
BTCS 617-18UC Soft Computing lab

Elective-V

BTCS 704-18UC Quantum Computing
BTCS 705-18UC Big Data Analytics
BTCS 706-18UC Speech and Natural Language Processing
BTCS 707-18UC Quantum Computing lab
BTCS 708-18UC Big Data Analytics lab
BTCS 709-18UC Speech and Natural Language Processing lab

Elective-VI

BTCS 710-18UC	Block Chain Technologies
BTCS 711-18UC	Software Defined Networking
BTCS 712-18UC	Digital Image Processing
BTCS 713-18UC	Block Chain Technologies Lab
BTCS 714-18UC	Software Defined Networking Lab
BTCS 715-18UC	Digital Image Processing Lab

- **Open Electives for students of CSE:**
  Students can opt. courses from the list of Open Electives offered by other departments of the institute.
  OR
  Students can select a MOOC Couse duly approved by the MOOC coordinate of their department from time to time.

Open electives offered by the department:

Courses of odd semesters:

BTCS301-18	Enterprise Resource Planning
BTCS302-18	Cyber laws and IPR
BTCS501-18	Database Management System
BTCS504-18	Computer Networks
BTCS710-18UC	Block Chain Technologies
BTCS712-18UC	Digital Image Processing
BTCS716-18UC	Parallel Computing
BTCS717-18UC	Symbolic Logic and Logic Processing

Courses of even semesters:

BTES401-18	Computer Organisation & Architecture
BTCS402-18	Operating System
BTCS618-18UC	Internet of Things
BTCS619-18UC	Cyber Security

LIST OF COURSES FOR HONOURS DEGREE

In order to have an Honours degree, a student choose 18-20 credits from the following courses in addition.

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS H01-18	Professional Elective Courses	Graph Theory	3	0	0	40	60	100	3
BTCS H02-18	Professional Elective Courses	Computer Vision	3	0	0	40	60	100	3
BTCS 618-18	Professional Elective Courses	Embedded Systems	3	0	0	40	60	100	3
BTCS H03-18	Professional Elective Courses	Software Project Management	3	0	0	40	60	100	3
BTCS H04-18	Professional Elective Courses	Cryptography & Network Security	3	0	0	40	60	100	3
BTCS H05-18	Professional Elective Courses	Internet-of-Things	3	0	0	40	60	100	3
BTCS 805-18	Professional Elective Courses	Data Analytics	3	0	0	40	60	100	3
BTCS 701-18	Professional Elective Courses	Machine Learning	3	0	0	40	60	100	3
BTCS H06-18	Professional Elective Courses	ICT in Agriculture and Rural Development	3	0	0	40	60	100	3
BTCS H07-18	Professional Elective Courses	Computational Technologies for Smart Cities	3	0	0	40	60	100	3
BTCS H08-18	Professional Elective Courses	Computer Forensics	3	0	0	40	60	100	3

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.

Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
		L	T	P	Internal	External		
PCC	Data structure Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
PCC	Object Oriented Programming Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
PCC	Computer networks Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
PCC	Operating system Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5
ESC	Computer Organisation and architecture Theory & Lab	3	0	2	40T+30 P	60T+20 P	150	4
PCC	Database Management system Theory & Lab	3	0	4	40T+30 P	60T+20 P	150	5

***For course code refer to scheme given above.**

*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.

List of Electives: 3 courses can be opted, other than studied in regular course.

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 Analysis 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 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

***For course code refer to scheme given above.**

Third Semester

Course Code: BTCS301-18	**Course Title:** Data Structure & Algorithms	**3L:0T:0P**	**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; &
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.

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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, Copy constructors, 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 & Algorithms Lab	**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.

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Course Code: BTCS304-18	**Course Title:** Object Oriented Programming Lab	**0L:0T:4P**	**2Credits**

List of Experiment:

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)**	**3L:0T:0P**	**3 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.

<u>Textbooks/References:</u>

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.

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)

2.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.
14. Passmore, John, Hundred Years of Philosophy, Penguin.

4. OTHER SESSIONS:

- 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.

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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.

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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-and add, 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.

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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, Strict Alternation, Peterson's Solution, The Producer\Consumer Problem, Semaphores, Event Counters, 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: Memory Management

Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and 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, Allocation methods (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

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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.

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.

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Course Code: BTES402-18	**Course Title:** Computer Organization & Architecture Lab	**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 Microcontrollers by 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.

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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.

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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 forself-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 inharmony 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!

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' - happiness and physical facility
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 Health; correct appraisal of Physical needs, meaning of Prosperityin detail
6. 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

1. 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 ofrelationship.
2. Understanding the meaning of Trust; Difference between intention and competence
3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values inrelationship.
4. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals.
5. Visualizing a universal harmonious order in society- Undivided Society,
6. 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

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfilment among the four orders of nature - recyclability and self-regulation in nature
3. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
4. 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

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 peoplefriendly and eco -friendly production systems, c. Ability to identify and develop appropriatetechnologies 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.
7. 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.
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.

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Course Code: EVS101-18	Course Title: Environmental Studies	3L:0T:0P	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
   i. 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

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

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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.

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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

a. 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.

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.

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Course Code:BTCS401-18	Course Title: 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, Identitiesof 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

Suggested books:
1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
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

Course Code: BTCS501-18	Course Title: Database Management Systems	3L:0T:0P	3 Credits

Detailed contents

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](CO 1, 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](CO 2,4)

Module 3: Storage strategies: Indices, B-trees, hashing. **[3hrs](CO 3)**

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](CO 5, 6)**

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 4, 6)**

Course Outcomes:

At the end of the course the student should be able to:

CO 1: For a given query write relational algebra expressions for that query and optimize the developed expressions

CO 2: For a given specification of the requirement design the databases using ER method and normalization.

CO 3: For a given specification construct the SQL queries for Open source and Commercial DBMS - MYSQL, ORACLE, and DB2.

CO 4: For a given query optimize its execution using Query optimization algorithms

CO 5: For a given transaction-processing system, determine the transaction atomicity, consistency, isolation, and durability.

CO 6: Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Suggested Books:

1. **“Database System Concepts”**, 6th Edition by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, McGraw-Hill.

<u>Suggested reference books</u>

1 **“Principles of Database and Knowledge – Base Systems”**, Vol 1 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.

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Course Code : BTCS 502-18	Course Title: Formal Language & Automata Theory	3L:1T:0P	3Credits

Detailed contents

Module 1: Introduction: Alphabet, languages and grammars, productions and derivation, Chomsky hierarchy of languages. 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. 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. Context-sensitive languages: Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. 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. Undecidability: Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice s theorem, undecidable problems about languages.

[4hrs](CO 1)

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 off finite automata.

[8hrs](CO 2, 3)

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](CO 4, 5)**

Module 4: Context-sensitive languages Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG. **[6hrs](CO 5)**

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 5.6)**

Module6: Undecidability Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rices theorem, undecidable problems about languages. **[8hrs](CO 7)**

Course Outcomes:

At the end of the course the student should be able to:

CO 1: Write a formal notation for strings, languages and machines.

CO 2: Design finite automata to accept a set of strings of a language.

CO 3: For a given language determine whether the given language is regular or not.

CO 4: Design context free grammars to generate strings of context free language.

CO 5: Determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars

CO 6: Write the hierarchy of formal languages, grammars and machines.

CO 7: Distinguish between computability and non-computability and Decidability and undecidability.

Suggested books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, **Introduction to Automata Theory, Languages, and Computation**, Pearson Education Asia.

Suggested 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: BTCS 503-18	**Course Title : Software Engineering**	**3L:0T:0P**	**3 Credits**

Detailed Contents:

UNIT 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.

[**8hrs] (CO 1)**

UNIT 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.

[6hrs] (CO 2)

UNIT 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.

[**8 hrs] (CO 3)**

UNIT 4: Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management

[**8 hrs] (CO 4)**

UNIT 5: ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development.

[**6 hrs] (CO 5)**

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: Analyze 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

Suggested Readings/ Books:

1. Roger Pressman, **"Software Engineering: A Practitioners Approach,** (6th Edition), McGraw Hill,

1. 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.

Detailed Contents:

Course Code: BTCS 504 -18	Course Title: Computer Networks	3L:0T:0P	3Credits

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.

[8 hrs] (CO 1)

Module 2: Data Link Layer and Medium Access SubLayer

Error Detection and Error Correction- Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols-Stop and Wait, Goback–NARQ, Selective Repeat ARQ, Sliding Window, Piggy backing, Random Access, Multiple access protocols- Pure ALOHA, Slotted ALOHA, CSMA/CDCDMA/CA.

[10 hrs] (CO 2)

Module 3: Network Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP – Delivery, Forwarding and Unicast Routing protocols.

[8 hrs] (CO 3)

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] (CO 3)

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] (CO 4)

Course Outcomes:

The student will be able to:
CO 1: Explain the functions of the different layer of the OSI Protocol
CO 2: Describe the function of each block of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs);
CO 3: Develop the network programming for a given problem related TCP/IP protocol
CO 4: Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

Suggested 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. **Internet working with TCP/IP**, Volume1, 6th Edition Douglas Comer, Prentice Hall of India.
3. **TCP/IP Illustrated**, Volume1, W. Richard Stevens, Addison-Wesley, United States of America.

Elective-I

Course Code: BTCS 508-18	Course Title: Programming in JAVA	3L:0T:0P	3 Credits

Detailed Contents:

Unit 1:

Overview: Object oriented programming principles, Java essentials, java virtual machine, program structure in java

Java class libraries, Data types, Variables and Arrays, Data types and casting, automatic type promotion in expressions, arrays.

Operators and Control Statements: Arithmetic operators, bit wise operators, relational operators, Boolean logical operators, the? Operator, operator precedence

Java's selection statements, iteration statements, jump statements.

CO 1

UNIT 2:

Introduction to Classes: Class fundamentals, declaring class, creating objects

Introducing methods: method declaration, overloading, using objects as parameters, recursion

Constructors, this keyword, garbage collection, the finalization

CO 1

UNIT 3:

Inheritance: Inheritance basics, using super and final, method overriding, dynamic method dispatch, Abstract Class

Interface: variables and extending Interfaces

Package: Creating and importing packages, Package access protection,

Exception Handling: Exception handling fundamentals, Exception types, Uncaught Exceptions Using try and catch, multiple catch clauses, nested try statements, throw, Java's built-in exceptions.

CO 1,2

UNIT 4:

Multithreaded Programming: The Java thread model, the main thread, creating thread, creating multiple threads, using is Alive () and join (), Thread priorities, synchronization, Inter thread communications, suspending resuming and stopping threads.

CO 3

UNIT5:

I/O: I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing Files

Applets: Applet Fundamentals, Applet Architecture, The HTML Applet tag, Passing parameters to Applets.

Networking: Networking basics, Java and the Net, TCP/IP Client Sockets URL, URL Connection, TCP/IP Server Sockets, Database connectivity.

CO 4

Course Outcomes:

At the end of the course the student should be able to:

CO1: Understand the features of Java such as opeartors, classes, objects, inheritance, packages and exception handling

CO2: Learn latest features of Java like garbage collection, Console class, Network interface, APIs

CO3: Acquire competence in Java through the use of multithreading, applets

CO4: Get exposure to advance concepts like socket and database connectivity.

Suggested Readings/Books

1. Herbert Schildt, **The Complete Reference Java 2**, McGraw-Hill.
2. Joyce Farrell, **Java for Beginners**, Cengage Learning.
3. Deitel and Deitel, **Java: How to Program**, 6th Edition, Pearson Education.
4. James Edward Keogh, Jim Keogh, J2EE: **The complete Reference**, Mc Graw Hill
5. Khalid A. Mughal, Torill Hamre, Rolf W. Rasmussen, **Java Actually**, Cengage Learning.
6. Shirish Chavan, **Java for Beginners**, 2nd Edition, Shroff Publishers.

Course Code: BTCS 509-18	Course Title: Web and Open Source Technologies	3L:0T:0P	3 Credits

Detailed Syllabus:

Introduction to WWW: Protocols and programs, secure connections, application and development tools, the web browser, Server, choices, setting up UNIX and Linux web servers, Logging users, dynamic IP

Web Design: Web site design principles, planning the site and navigation

Introduction to HTML: The development process, Html tags and simple HTML forms, web site structure

Introduction to XHTML: XML, Move to XHTML, Meta tags, Character entities, frames and frame sets, inside browser.

Style sheets : Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

JavaScript: Client side scripting, Javascript, How to develop Javascript, simple Javascript, variables, functions, conditions, loops and repetition.

Advance script, Javascript and objects, Javascript own objects, the DOM and web browser environments, forms and validations

DHTML: Combining HTML, CSS and Javascript, events and buttons, controlling your browser

CO 1

Ajax: Introduction, HTTP request, XHttpResponse, AJAX Server Script, AJAX Database, Advantages & disadvantages, Purpose of it, Ajax based web application, alternatives of Ajax

XML: Introduction to XML, uses of XML, simple XML and XML key components, DTD and Schemas, Well formed, using XML with application.XML, XSL and XSLT. Introduction to XSL, XML transformed simple example, XSL elements, transforming with XSLT **CO 2**

PHP: Starting to script on server side, syntax, statements, operators, Arrays, function and forms sessions, E-mail, PHP and AJAX, advance PHP

MySQL Databases : Basic command with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHPmyadmin and database bugs.

JavaScript Library & Web-Framework:

Jquery: Introduction, Why jQuery, jQuery methods for DOM manipulation, jQuery methods for CSS manipulation, jQuery AJAX Methods (Asynchronous JavaScript and XML)

AngularJS: Fundamental structural concepts of AngularJS, AngularJS Directives, AngularJS Expressions, Use of custom attributes in HTML, introduction to modules and controllers, form validation using validation rules, Server Communication & Data Binding techniques. **CO 3**

Course Outcomes:

At the end of the course the student should be able to:
CO 1: Students are able to develop a dynamic webpage by the use of java script and DHTML.
CO 2: Students will be able to write a well formed / valid XML document.

CO 3: Students will be able to write a server side java application called JSP to catch form data sent from client and store it on database

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, Java Script,Perl, Python and PHP**, Wiley India Textbooks.
6. R. Peterson, 2007, **Linux: The Complete Reference**, Sixth Edition, TMH.

Course Code: BTCS 510-18	Course Title: Programming in Python	3L:0T:0P	3 Credits

Detailed Syllabus:

UNIT - I 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

CO 1,2

UNIT - II 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

CO 2,3

UNIT - III 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

CO 3,4

UNIT - IV 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

CO 4,5

UNIT – V Database Programming: Introduction, Python Database Application Programmer's Interface (DB-API), Object Relational Managers (ORMs), Related Modules

CO 5

<u>Course Outcomes</u>:

At the end of the course the student should be able to:

CO 1: Examine Python syntax and semantics and be fluent in the use of Python flow control and functions.

CO 2: Demonstrate proficiency in handling Strings and File Systems.

CO 3: Create, run and manipulate Python Programs using core data structures like Lists, Dictionaries and use Regular Expressions.

CO 4: Interpret the concepts of Object-Oriented Programming as used in Python.

CO 5: Implement exemplary applications related to Network Programming, Web Services and Databases in Python.

Suggested Readings/Books

1. Textbook 1**. Core Python Programming**, Wesley J. Chun, Second Edition, Pearson.

Elective-II

Course Code: BTCS 514-18	Course Title: Mobile Application Development	3L:0T:0P	3 Credits

Detailed Syllabus:

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

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

CO 1, 2

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

CO 2,3

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

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

CO 4,5

Unit-VI

Platforms and Additional Issues: Development Process, Architecture, Design, Technology Selection, Testing, Security and Hacking, Active Transactions, More on Security

CO 4

Unit-VII

Deployment of apps: Versioning, signing and packaging mobile apps, distributing apps on market place.

CO 5

Course Outcomes:

At the end of the course the student should be able to:
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. T1.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,WroxPublisher,"**Professional Mobile Application Development**", Ist Edition, 2012.
5. Reto Meier, "**Professional Android 4 Application Development**", Wrox, 2012.

Course Code: BTCS 515-18	Course Title: Computer Graphics	3L:0T:0P	3 Credits

Detailed Syllabus:

UNIT–I

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.

CO 1

Unit- II

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.

CO 2

Unit- III

Two-Dimensional Geometric Transformation: Translation, Rotation, Scaling, Reflection, Shearing, Matrix representations; Composite transformations.

CO 2

UNIT–IV

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.

CO 3, 4

Unit- V

Three Dimensional Transformations & Viewing: Translation, Rotation, Scaling, Reflection and composite transformations. Parallel and Perspective Projections, Viewing Transformation: View Plan, View Volumes and Clipping.

CO 4, 5

Unit- VI

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.

CO 5

Unit –VII

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.

CO 5, 6

UNIT–VIII

Animation: Graphics Design of Animation sequences, General Computer Animation Functions Introduction to Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

CO 6

Course Outcomes:

At the end of the course the student should be able to:

CO 1. To list the concepts used in computer graphics.

CO 2. To implement various algorithms to scan, convert the basic geometrical primitives, transformations, Area filling, clipping.

CO 3. To describe the importance of viewing and projections.

CO 4. To define the fundamentals of animation, virtual reality and its related technologies.

CO 5. To understand a typical graphics pipeline

CO 6. To design an application with the principles of virtual reality

References:

1. D. Hearn and M.P. Baker, **Computer Graphics: C version**, 2nd Edition, PHI, 2004.
2. D.F. Rogers, **Procedural Elements for Computer Graphics**, 2nd Edition, Addison Wasley, 2004.
3. D.F. Rogers, **Mathematical Elements for Graphics**, 2nd Edition. McGraw Hill, 2004.
4. J.D. Foley et al, **Computer Graphics, Principles and Practices**, 2nd Edition, Addison Wasley, 2004.
5. Roy A. Plastock, Gordon Kalley, **Computer Graphics**, Schaum's Outline Series, 1986.

Course Code: BTCS 516-18	**Course Title: Internet of Things**	**3L:0T:0P**	**3Credits**

Detailed Syllabus:

1. Introduction to IoT (8 Hours)

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.

CO 1

2. Elements of IoT (9 Hours)

Hardware Components- Computing (Arduino, Raspberry Pi), Communication, Sensing, Actuation, I/O interfaces.

Software Components- Programming API's (using Python/Node.js/Arduino) for Communication CO2

Protocols-MQTT, ZigBee, Bluetooth, CoAP, UDP, TCP.

CO 2

3. IoT Application Development (18 Hours)

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.

CO 3

4. IoT Case Studies (10 Hours)

IoT case studies and mini projects based on Industrial automation, Transportation, Agriculture, Healthcare, Home Automation

CO 4

Course Outcomes:

At the end of the course the student should be able to:

CO 1. To understand internet of Things and its hardware and software components

CO 2. To develop an Interface I/O devices, sensors & communication modules

CO 3. To remotely monitor data and control devices

CO 4. To develop real life IoT based projects

LIST OF SUGGESTED BOOKS

1. Vijay Madisetti, Arshdeep Bahga, **İnternet 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: BTCS 505-18	Course Title: Database management System lab	0L:0T:4P	2 Credits

Detailed List of Tasks:

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 Statemets.
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

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	1Credits

Detailed List of Tasks:

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
4. related documents for some problems
5. Preparation of Software Configuration Management and Risk Management related documents
6. Study and usage of any Design phase CASE tool
7. To perform unit testing and integration testing
8. To perform various white box and black box testing techniques
9. Testing of a web site

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

Course Code: BTCS507-18	Course Title: Computer Networks Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

Task1: To study the different types of Network cables and network topologies

Task2: Practically implement and test the cross-wired cable and straight through cable using clamping tool and network lab cable tester.

Task3: Study and familiarization with various network devices.

Task4: Familiarization with Packet Tracer Simulation tool/any other related tool. Task5: Study and

Implementation of IP Addressing Schemes

Task6: Creation of Simple Networking topologies using hubs and switches

Task7: Simulation of web traffic in Packet Tracer

Task8: Study and implementation of various router configuration commands

Task9: Creation of Networks using routers.

Task10: Configuring networks using the concept of subnetting

Task11: Practical implementation of basic network command and Network configuration commands like ping, ipconfig, netstat, tracert etc. for trouble shooting network related problems.

Task12: Configuration of networks using static and default routes.

Course Outcomes:

The students will be able to

1. Know about the various networking devices, tools and also understand the implementation of network topologies.
2. Create various networking cables and know how to test these cables.
3. Create and configure networks in packet tracer tool using various network devices and topologies.
4. Understand IP addressing and configure networks using the subnettin.
5. Configure routers using various router configuration commands.
6. Trouble shoot the networks by using various networking commands. Graphics Software's.

Elective-I Lab

Course Code: BTCS511-18	**Course Title: Programming in Java Lab**	**0L:0T:2P**	**1Credits**

To accomplish CO1;

1. WAP in Java to show implementation of classes.
2. WAP in Java to show implementation of inheritance.
3. WAP in Java to show Implementation of packages and interfaces.

To accomplish CO2;

4. WAP in Java to show Implementation of threads.
5. WAP in Java Using exception handling mechanisms.
6. WAP in Java to show Implementation of Applets.

To accomplish CO3;

7. WAP in Java to show Implementation of mouse events, and keyboard events.
8. WAP in Java to show Implementing basic file reading and writing methods.
9. Using basic networking features, WAP in Java

To accomplish CO4;

10. WAP in Java to show Connecting to Database using JDBC.

Project work: A desktop based application project should be designed and implemented in java.

Course Outcomes:

At the end of the course the student should be able to:

CO1. Implement the features of Java such as opeartors, classes, objects, inheritance, packages and exception handling

CO2. Design problems using latest features of Java like garbage collection, Console class, Network interface, APIs

CO3. Develop competence in Java through the use of multithreading, Applets etc

CO4. Apply advance concepts like socket and database connectivity, and develop project based on industry orientation.

Suggested Readings/Books

1. Herbert Schildt, The Complete Reference Java2, McGraw-Hill.
2. Deitel and Deitel, Java: How to Program, 6th Edition, Pearson Education.
3. James Edward Keogh, Jim Keogh, J2EE: The complete Reference, Mc Graw Hill

Course Code: BTCS 512-18	Course Title: Web and Open Source Technologies Laboratory	0L:0T:2P	1Credits

Detailed List of Tasks:

1. Write an HTML page including javascript that takes a given set of integer numbers and shows them after sorting in descending order.
2. Write an HTML page that has one input, which can take multi-line text and a submit button. Once the user clicks the submit button, it should show the number of characters, words and lines in the text entered using an alert message. Words are separated with white space and lines are separated with new line character.
3. Write an HTML page that contains a selection box with a list of 5 countries. When the user selects a country, its capital should be printed next to the list. Add CSS to customize the properties of the font of the capital (color, bold and font size).
4. Create an XML document that contains 10 users information.
5. Using jQuery find all children in a specified class of a division
6. Find all elements of a form that are disabled
7. Create an input form and validate using jQuery. Highlight inputs elements if errors occur
8. Build a Single Page Application (SPA) using AngularJS.

Course Code: BTCS 513-18	Course Title: Programming in Python Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

1. Write a program to demonstrate different number data types in Python.
2. Write a program to perform different Arithmetic Operations on numbers in Python. 3. Write a program to create, concatenate and print a string and accessing sub-string from a given string.
3. Write a python script to print the current date in the following format “Sun May 29 02:26:23 IST 2017”
4. Write a program to create, append, and remove lists in python.
5. Write a program to demonstrate working with tuples in python.
6. Write a program to demonstrate working with dictionaries in python.
7. Write a python program to find largest of three numbers.
8. Write a Python program to convert temperatures to and from Celsius, Fahrenheit. [Formula: c/5 = f-32/9]

9. Write a Python program to construct the following pattern, using a nested for loop

```
*
* *
* * *
* * * *
* * * * *
* * * *
* * *
* *
*
```

10. Write a Python script that prints prime numbers less than 20.
11. Write a python program to find factorial of a number using Recursion.
12. 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).
13. Write a python program to define a module to find Fibonacci Numbers and import the module to another program.
14. Write a python program to define a module and import a specific function in that module to another program.
15. 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.
16. Write a program that inputs a text file. The program should print all of the unique words in the file in alphabetical order.
17. Write a Python class to convert an integer to a roman numeral.
18. Write a Python class to implement pow(x, n)
19. Write a Python class to reverse a string word by word.

Elective-II Lab

Course Code: BTCS 517-18	Course Title: Mobile Application Development Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

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, broadcast receivers, data components
7. Using emulator to deploy and run mobile apps
8. Testing mobile app- unit testing, black box testing and test automation

Course Code: BTCS518-18	Course Title: Computer Graphics Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

1. WAP to draw different geometric structures using different functions.
2. Implement DDA line generating algorithm.
3. Implement Bresenham's line generating algorithm.
4. Implement Mid-point circle line generating algorithm.
5. Implementation of Bresenham's circle drawing algorithm.
6. Implementation of mid-point circle generating Algorithm.
7. Implementation of ellipse generating Algorithm.
8. WAP of color filling the polygon using Boundary fill and Flood fill algorithm.
9. To translate an object with translation parameters in X and Y directions.
10. To scale an object with scaling factors along X and Y directions.
11. Program of line clipping using Cohen-Sutherland algorithm.
12. To perform composite transformations of an object.
13. To perform the reflection of an object about major

Course Code: BTCS 519-18	Course Title: Internet of Things Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

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 things peak cloud.
10. Write a program on Arduino/Raspberry Pi to retrieve temperature and humidity data from thing speak 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.

Sixth Semester

Detailed Contents:

Course Code: BTCS601-18UC	Course Title : Compiler Design	3L:0T:0P	3 Credits

UNIT 1: Introduction: Compiler structure: analysis-synthesis model of compilation, phases of a compiler**.**

Lexical Analysis: Interface with input buffer, parser and symbol table. Token, lexeme and patterns. Difficulties, error reporting and implementation

[**8hrs] (CO 1,2)**

UNIT 2: Context-free language: Context-free language and grammar, push-down automata, LL(1) grammar, ambiguity, associativity, precedence.
Syntax analysis: Top down parsing, recursive descent parsing, transformation on the grammars, predictive parsing, bottom up parsing, LR parsers: SLR, LALR and LR. Error recovery of parsers.

12hrs] (CO1, 2)

UNIT 3: Semantic Analysis: Syntax directed definitions, inherited and synthesized attributes, dependency graph, evaluation order and evaluation of attributes, L and S attribute.

[6hrs] (CO 1,2)

UNIT 4: Symbol Table: Structure, symbol attributes, storage and management.
Run-time environment: Procedure activation, parameter passing, value return, memory allocation, and scope. **[6hrs] (CO 2)**

UNIT 5: Intermediate code generation: intermediate representations, translation of declarations, assignments, control flow, Boolean expressions and procedure calls. Implementation issues.

[6hrs] (CO 3)

UNIT 6: Code generation and instruction selection: issues, basic blocks and flow graphs, register allocation, code generation, dag representation of programs, code generation from dags, peep hole optimization, Architecture dependent code improvement: instruction scheduling for pipeline, loop optimization for cache memory.

[8hrs] (CO 4, 5)

Course Outcomes:

At the end of the course the student should be able to:

CO 1: Understand the major phases of compilation including front-end and back-end.

CO 2: Develop the parsers and experiment the knowledge of different parsers design

CO 3: Construct the intermediate code representations and generation

CO 4: Convert source code for a novel language into machine code for a novel computer

CO 5: Apply for various optimization techniques for dataflow analysis

Text Books:

1. AlfredAho, Ravi Sethi, Jeffrey D Ullman, "Compilers Principles, Techniques and Tools", Pearson

Education Asia, 2003
2. Allen I. Holub "Compiler Design in C", Prentice Hall of India, 2003.
3. C. N. Fischer and R. J. LeBlanc, "Crafting a compiler with C", Benjamin Cummings, 2003.
4. J.P. Bennet, "Introduction to Compiler Techniques", Second Edition, Tata McGraw-Hill, 2003.
5. HenkAlblas and Albert Nymeyer, "Practice and Principles of Compiler Building with C", PHI, 2001.
6. Kenneth C. Louden, "Compiler Construction: Principles and Practice", Thompson Learning, 2003

Course Code: BTCS602-18UC	**Course Title : Artificial Intelligence**	**3L:1T:0P**	**3 Credits**

Detailed Contents:

UNIT 1: Introduction: AI problems, Agents and Environments, Structure of Agents, Problem Solving Agents Basic Search Strategies: Problem Spaces, Uninformed Search (Breadth-First, Depth-First Search, Depth-first with Iterative Deepening), Heuristic Search (Hill Climbing, Generic Best-First, A*), Constraint Satisfaction (Backtracking, Local Search)

[8hrs] (CO 1)

UNIT 2: Advanced Search: Constructing Search Trees, Stochastic Search, A* Search Implementation, Minimax Search, Alpha-Beta Pruning Basic Knowledge Representation and Reasoning: Propositional Logic, First-Order Logic, Forward Chaining and Backward Chaining, Introduction to Probabilistic Reasoning, Bayes Theorem

[6hrs] (CO 2)

UNIT 3: Advanced Knowledge Representation and Reasoning: Knowledge Representation Issues, Nonmonotonic Reasoning, Other Knowledge Representation Schemes Reasoning Under Uncertainty: Basic probability, Acting Under Uncertainty, Bayes' Rule, Representing Knowledge in an Uncertain Domain, Bayesian Networks

[6hrs] (CO 3)

UNIT 4: Learning: What Is Learning? Rote Learning, Learning by Taking Advice, Learning in Problem Solving, Learning from Examples, Winston's Learning Program, Decision Trees.

[6hrs] (CO 4)

UNIT 5: Expert Systems: Representing and Using Domain Knowledge, Shell, Explanation, Knowledge Acquisition.

[6hrs] (CO 5)

Course Outcomes:

At the end of the course the student should be able to:

CO 1: Understand different types of AI agents.

CO 2: Develop different types of various AI search algorithms.

CO 3: Construct simple knowledge-based systems and to apply knowledge representation.

CO 4: Convert intermediate representation in contest to understand learning.

CO 5: Apply for various techniques for Expert Systems.

Text Book:

1. Russell, S. and Norvig, P, Artificial Intelligence: A Modern Approach, Third Edition, PrenticeHall, 2010.

Reference Books:

1. Artificial Intelligence, Elaine Rich, Kevin Knight, Shivasankar B. Nair, The McGraw Hill publications, Third Edition, 2009.

2. George F. Luger, Artificial Intelligence: Structures and Strategies for Complex Problem Solving, Pearson Education, 6th ed., 2009.

Course Code: BTCS606-18UC	**Course Title: Network Security and Cryptography**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: **Overview of Network Security**
Internet Architecture Vulnerabilities, Network Security Terminology: Identification, Confidentiality, Authentication, Authorization, Access Control, Integrity, Non-Repudiation, Freshness, and Availability, Network Threats and Types of attacks, Introduction to malwares.

[4hrs] (CO 1,2)

UNIT 2: **Cryptography**
Symmetric Cipher Model, Classical Cryptographic Algorithms: Monoalphabetic Substitutions such as Caesar Cipher, Cryptanalysis of Monoalphabetic ciphers; Polyalphabetic Ciphers such as Vigenere, Vernam Cipher; Transposition Cipher. Stream and Block Ciphers, Block cipher: principles, Data Encryption Standard (DES), Analyzing and Strengthening of DES, Introduction to Advance Encryption Standard (AES), modes of operations, Concept of Asymmetric Cryptography, Rivets-Shamir-Adleman (RSA) Key Generation, Encryption and Decryption Algorithm

[6hrs]

UNIT 3: **Key Management Protocols:**
Solving Symmetric Key Distribution Problem, Diffie-Hellman Algorithm, Key Exchange with Public Key Cryptography or Asymmetric Cryptography, Digital Envelope, ELGamal Cryptosystem, Public Key Certificate Structure, Distribution of Public Key, Certificate Authority

[5hrs] (CO 3)

UNIT 4: **Hash Algorithms & Digital Signature**
Hash concept, Hash Function Requirements, Popular Message Digest and Hash Algorithms: MD4 and MD5, Secure Hash Algorithms such as SH1 and SHA2, Digital Signature, Digital Signature Standard (DSA)

[5hrs] (CO 2,4)

UNIT 5: **Authentication Protocols**
Basic authentication protocols, concept of Key distribution centre (KDC), Needham-Schroeder Authentication Protocol, Kerberos, writing authentication protocols using KDC and public key cryptography

[5hrs]

UNIT 6: **IP Security**
Why IP security: IP security Architecture, Authentication Header, Encapsulating Security Payload.

[5hrs] (CO 4)

UNIT 7: **Web Security**
Web security consideration, Secure Socket Layer Protocol, Transport Layer Security, Secure Electronic Transaction Protocol.

[4hrs] (CO 2,5)

UNIT 8: **Firewalls**
Firewall Design principles, Trusted Systems, Virtual Private Networks.

[4hrs] (CO 6)

Course Outcomes: At the end of the course the student should be able to:

CO 1: Understand real time systems for identifying security threats.
CO2: Compare public and private cryptographic algorithms and make use of the same for encryption and decryption of messages.
CO3: Design confidential systems with minimum possible threats.
CO4: Apply both cryptography and hashing to create digital signatures and certificates for achieving integrity.
CO5: Understand application of cryptosystems in design of, IPSec, AH, and ESP protocols.
CO6: Understand and compare https vs SET protocols and Firewall Vs Virtual Private Network.

Text Books:

1. Principles of Cryptography, 4th Edition by William Stallings, Pearson Education.
2. Security in Computing, 2nd Edition by Charles P.Pfleeger, Prentice Hall International.
3. Cryptography & Network Security, 2nd Edition by Atul Kahate, TMH.
4. Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2nd Edition by Bruce Schneier, John Wiley and Sons.
5. Firewalls and Internet Security, 2nd Edition by Bill Cheswick and Steve Bellovin, Addison-Wesley.
6. Security Technologies for the world wide web, 2nd Edition by Rolf Oppliger, Artech House, Inc.

Course Code: BTCS607-18UC	Course Title : Data Mining	3L: 0T: 0P	3Credits

Detailed Contents:

UNIT-1 **[8 hrs] (CO1)**

Introduction to data mining: Motivation and significance of data mining, data mining functionalities, interestingness measures, classification of data mining system, major issues in data mining, Knowledge Discovery in Databases Vs Data mining, DBMS Vs Data Mining, Data Mining Technique, DM Application Areas.

Data Ware Housing: Introduction, Multidimensional data model, OLAP Operation, Warehouse schema, Data Ware Housing Architecture, Warehouse Server, Metadata, OLAP, engine.

UNIT-II **[6 hrs] (CO2)**

Data pre-processing: Need, data summarization, data cleaning, data integration and transformation, data reduction techniques – Singular Value Decomposition (SVD), Discrete Fourier Transform (DFT), Discrete Wavelet Transform (DWT), data discretization and concept hierarchy generalization.

UNIT-III **[8 hrs] (CO3)**

Association rules: -Introduction, Methods to discover association rules, A Priori Algorithm, Partition Algorithm, Pincer –Search algorithm, Dynamic Item set counting algorithm, FP-tree Growth algorithm, Incremental algorithm, Border algorithm.

Clustering Techniques: - Introduction, Clustering paradigms, Partitioning algorithms, k-Mean Algorithm, k-Medoid Algorithm, CLARA, CLARANS, Hierarchical clustering, DBSCAN, BIRCH, CURE, Categorical clustering algorithms, STIRR, ROCK, CACTUS.

UNIT-IV **[6 hrs] (CO4)**

Classification and prediction: Definition, decision tree induction, Bayesian classification, rule-based classification, classification by backpropagation and support vector machines, associative classification, lazy learners, prediction, accuracy and error measures.

UNIT -V **[4 hrs] (CO5)**

Data mining on complex data and applications: Algorithms for mining of spatial data, multimedia data, text data; Data mining applications, social impacts of data mining, trends in data mining.

<u>Course Outcomes:</u>

At the end of the course the student should be able to:

CO1: Understand various concepts, algorithms and techniques in data mining and warehousing and their applications.

CO2: Develop preprocessing techniques for data cleansing

CO3: Construction algorithms for Association Rules and clustering techniques.

CO4: Identify different classification techniques.

CO5: Apply the real time applications of data mining

Text Books:

1. Han, J. and Kamber, M., "Data Mining - Concepts and Techniques", 3rd Ed., Morgan Kaufmann Series. 2011
2. Ali, A. B. M. S. and Wasimi, S. A., "Data Mining - Methods and Techniques", Cengage Publishers. 2009
3. Tan, P.N., Steinbach, M. and Kumar, V., "Introduction to Data Mining", Addison Wesley – Pearson. 2008
4. Pujari, A. K., "Data Mining Techniques", 4th Ed., Sangam Book 2008

Course Code: BTCS608-18UC	Course Title : Cloud Computing	3L:0T:1	3 Credits

Detailed Contents:

UNIT 1: **Introduction to Cloud Computing:** Origins of Cloud Computing– Cloud components - Essential characteristics – On-demand selfservice, Broad network access, Location independent resource pooling, Rapid elasticity, Measured service, Comparing cloud providers with traditional IT service providers, Roots of cloud computing. Cloud Computing Reference Model. Historical Developments. **Virtualization:** Introduction, Characteristics of Virtualized Environment, Taxonomy of Virtualization Techniques, Virtualization and Cloud computing, Pros and Cons of Virtualization, Technology Examples- Microsoft Hyper-V. **Before the Move into**

the Cloud: Know Your Software Licenses, The Shift to a Cloud Cost Model, Service Levels for Cloud Applications.

[8hrs] (CO 1)

UNIT 2: Cloud Computing Architecture: Introduction, Architecture, Infrastructure / Hardware as a Service, Platform as a Service, Software as a Service, Types of Clouds, Public Clouds, Private Clouds, Hybrid Clouds, Community Clouds, Economics of the Cloud, Open Challenges, Cloud Interoperability and Standards, Scalability and Fault Tolerance. **Ready for the Cloud:** Web Application Design, Machine Image Design, Privacy Design, Database Management, Data Security, Network Security, Host Security, Compromise Response. Advantages of Cloud computing.

[6hrs] (CO 2)

UNIT 3: Defining the Clouds for Enterprise: Storage as a service, Database as a service, Process as a service, Information as a service, Integration as a service and Testing as a service. **Scaling a cloud infrastructure -** Capacity Planning, Cloud Scale. **Disaster Recovery:** Disaster Recovery Planning, Disasters in the Cloud, Disaster Management, Scheduling.

[6hrs] (CO 3)

UNIT 4: Cloud Simulators- CloudSim and GreenCloud : Introduction to Simulator, understanding CloudSim simulator, Understanding Working platform for CloudSim, Introduction to GreenCloud. **Introduction to VMWare Simulator:** Basics of VMWare, advantages of VMware virtualization, using Vmware workstation, creating virtual machines-understanding virtual machines, create a new virtual machine on local host, cloning virtual machines, virtualize a physical machine, starting and stopping a virtual machine**.**

[8hrs] (CO 4)

UNIT 5: Cloud Applications: Scientific Applications – Health care, Geoscience and Biology. Business and Consumer Applications- CRM and ERP, Social Networking, Media Applications and Multiplayer Online Gaming. **Cloud Platforms in Industry:** Amazon Web Services- Compute Services, Storage Services, Communication Services and Additional Services. Google AppEngine-Architecture and Core Concepts, Application Life-Cycle, cost model. Microsoft Azure- Azure Core Concepts, SQL Azure.

[6hrs] (CO 5)

<u>Course Outcomes:</u>

At the end of the course the student should be able to:

CO 1: Understand the necessary theoretical background for computing and storage clouds environments.

CO 2: Develop methodologies and technologies for the development of applications that will be deployed and offered through cloud computing environments.

CO 3: Construct the differences between Cloud deployment models

CO 4: Identify available Cloud Service Platforms and determine which works best for one’s needs

CO 5: An understanding of when and where to use it using the appropriate industry models

<u>Text Books:</u>

1. Cloud Computing and SOA Convergence in Your Enterprise A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
2. Cloud Computing 2 nd Edition by Dr. Kumar Saurabh from Wiley India 2012

3. Cloud computing for dummies- Judith Hurwitz , Robin Bloor , Marcia Kaufman ,Fern Halper, Wiley Publishing, Inc, 2010

Course Code: BTCS612-18UC	Course Title : Information Theory and Coding	3L:0T:0P	3Credits

Detailed Contents:

UNIT 1: Information Theory:

Introduction, Measure of information, Information content of message, Average Information content of symbols in Long Independent sequences, Average Information content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Mark off Sources **[6hrs] (CO 1)**

UNIT 2: Source Coding:

Source coding theorem, Prefix Codes, Kraft McMillan Inequality property – KMI ,Encoding of the Source Output, Shannon's Encoding Algorithm , Shannon Fano Encoding Algorithm, Huffman codes, Extended Huffman coding, Arithmetic Coding, Lempel – Ziv Algorithm

[6hrs] (CO 2)

UNIT 3: Information Channels:

Communication Channels, Channel Models, Channel Matrix, Joint probability Matrix, Binary Symmetric Channel, System Entropies, Mutual Information, Channel Capacity, Channel Capacity of :Binary Symmetric Channel, Binary Erasure Channel, Moraga's Theorem, Continuous Channels

[6hrs] (CO 3)

UNIT4: Error Control Coding:
Introduction, Examples of Error control coding, methods of Controlling Errors, Types of Errors, types of Codes
Linear Block Codes: matrix description of Linear Block Codes, Error Detection and Error Correction Capabilities of Linear Block Codes, Single Error Correcting hamming Codes, Table lookup Decoding using Standard Array.
Binary Cyclic Codes: Algebraic Structure of Cyclic Codes, Encoding using an (n-k) Bit Shift register, Syndrome Calculation, Error Detection and Correction

[8hrs] (CO 4)

UNIT 5: Some Important Cyclic Codes: Golay Codes, BCH Codes , Convolution Codes: Convolution Encoder, Time domain approach, Transform domain approach, Code Tree, Trellis and State Diagram, The Viterbi Algorithm **[6hrs] (CO 5)**

<u>Course Outcomes:</u>

At the end of the course the student should be able to:

CO 1: Understand various entropies and Define the information theories.

CO 2: Apply source coding techniques

CO 3: Compute the capacity of various types of channels.

CO 4: Understand and Construct codes using different error control techniques.

CO 5: Apply various coding schemes for text, speech and audio.

<u>Text Books:</u>

1. Information Theory and Coding, Murlidhar Kulkarni and K.S.Shivaprakasha, Wiley India, 2014, EDN-1
2. Information Theory, Coding and Cryptography, Ranjan Bose, Mcgraw Hill, 2019, 3rd edition
3. Information Theory and Coding: Basics and Practices, V, Veluswamy, New Age International Pvt. ltd., 2014, 1st edition
4. Elements of Information Theory, 2nd Ed., T. M. Cover, J.A. Thomas, Wiley-Interscience, New York, 2006
5. Foundations of Coding: Theory and Applications of Error-Correcting Codes with an Introduction to Cryptography and Information Theory, J. Adamek, Wiley-Interscience 1991

6. Information Theory and Coding, Girithar K., Pooja publications, 2010

Course Code:BTCS613-18UC	Course Title: Data Science	3L:0T:0P	3 Credits

Detailed Contents: **[8hrs] (CO 1)**

UNIT1: INTRODUCTION TO DATA SCIENCE

Introduction to Data Science and Its Importance, Data Science and Life Cycle of Data Science, The Architecture of Data Science, Working with Data, Data Cleaning, Data Munging, Data Manipulation. Establishing Computational Environments for Data Scientists Using Python with IPython and Jupyter notebook

[6hrs] (CO 2)

UNIT2: DATA SCIENCE USING NUMPY

Understanding Data Types in Python, The Basics of NumPy, Usage of NumPy, Computation on Numpy Arrays, Usage Universal Functions - Aggregations: Min, Max, And Everything in Between Computation on Arrays, Broadcasting Comparisons, Masks, And Boolean Logic Fancy Indexing-Sorting Arrays

[6hrs] (CO 3)

UNIT 3: DATA MANIPULATION WITH PANDAS

Installing and Using Pandas, Introducing Pandas Objects, Data Indexing and Selection. Operating on Data in Pandas, Handling Missing Data, Hierarchical Indexing Combining Datasets: Concat And Append, Combining Datasets: Merge and Join. Aggregation and Grouping, Pivot Tables, Vectorized String Operations, Working with Time Series.

[6hrs] (CO 4)

UNIT 4: DATA VISUALIZATION WITH MATPLOTLIB

General Matplotlib Tips, Simple Line Plots, Simple Scatter Plots, Visualizing Errors Density and Contour Plots, Histograms, Binnings, And Density, Customizing Plot Legends Customizing Colour bars, Multiple Subplots, Text And Annotation, Customizing Ticks Customizing Matplotlib: Configurations And Style Sheets, Geographic Data With Base map.

[6hrs] (CO 5)

UNIT 5: MACHINE LEARNING USING PYTHON

Introduction of Machine Learning, Various Categories of Machine Learning algorithms, Archtecture of Machine Learning Algorithm, Basics of Supervised and Unsupervised Machine Learning Algorithm, Usage of Scikit Application, Feature Engineering- Naive Bayes Classification, Linear Regression, k-Means Clustering.

Course Outcomes:

CO 1: Identify phases involved in the life cycle of Data Science

CO2: Understanding the number of mathematical operations and computation on arrays

CO 3: Manage the data for efficient storage and manipulation in Python

CO 4: Explore a flexible range of data visualizations approaches in Python.

CO 5: Analyse and create a Machine Learning Model for various types of data.

Text Books:

1. Pragmatic Machine Learning with Python, Avishek Nag, BPB Publication April 2020
2. Data Science with Jupyter, Prateek Gupta, BPB Publication, January 2019
3. Python Data Science Handbook-Essential Tools for Working with Data, Jake Vander Plas, O'Reilly Media, 2016.
4. Data Science from Scratch: First Principles with Python, Joel Grus, O'Reilly, 2015.
5. Python for Data Analysis, Wes Mckinney, O'Reilly Media, 2013.
6. Fundamentals of Data Science, Samuel Burns, Amazon KDP printing and Publishing, 2019.

Course Code: BTCS614-18UC	**Course Title: Soft Computing**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1:

Introduction: What is Soft Computing? Difference between Hard and Soft computing, Requirement of Soft computing, Major Areas of Soft Computing, Applications of Soft Computing

[**4hrs]**

UNIT 2:

Neural Networks: What is Neural Network, Learning rules and various activation functions, Single layer Perceptrons, Back Propagation networks, Architecture of Backpropagation(BP) Networks, Backpropagation Learning, Variation of Standard Back propagation Neural Network, Introduction to Associative Memory, Adaptive Resonance theory and Self Organizing Map, Recent Applications.

[10hrs]

UNIT 3:

Fuzzy Systems: Fuzzy Set theory, Fuzzy versus Crisp set, Fuzzy Relation, Fuzzification, Minmax Composition, Defuzzification Method, Fuzzy Logic, Fuzzy Rule based systems, Predicate logic, Fuzzy Decision Making, Fuzzy Control Systems, Fuzzy Classification

[8 hrs]

UNIT 4:

Genetic Algorithm: History of Genetic Algorithms (GA), Working Principle, Various Encoding methods, Fitness function, GA Operators- Reproduction, Crossover, Mutation, Convergence of GA, Bit wise operation in GA, Multi-level Optimization

[8 hrs]

UNIT 5:

Hybrid Systems: Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems, Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid Systems

[5 hrs]

Course Outcomes:

At the end of the course, the student should be able to:

- Understand various soft computing concepts for practical applications
- Design suitable neural network for real time problems
- Construct fuzzy rules and reasoning to develop decision making and expert system
- Apply the importance of optimization techniques and genetic programming
- Review the various hybrid soft computing techniques and apply in real time problems

Text Books:

1. S.Rajasekaran and G.A.Vijayalakshmi Pai, "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications", Prentice-Hall of India Pvt. Ltd., 2006.
2. George J. Klir, Ute St. Clair, Bo Yuan, Fuzzy Set Theory: Foundations and Applications Prentice Hall, 1997.
3. David E. Goldberg, Genetic Algorithm in Search Optimization and Machine Learning Pearson Education India, 2013.
4. James A. Freeman, David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Education India, 1991.

Course Code: BTCS618-18UC	**Course Title : Internet of Things**	**3L:0T:0P**	**3Credits**

Detailed Contents:

1. **Introduction to IoT:**
Architectural Overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology FundamentalsDevices 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, usage of Big Data Analytics as IoT, edge computing.

(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

Text 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

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Course Code: BTCS619-18UC	Course Title: Cyber Security	3L:0T:0P	3 Credits

Detailed Contents:

UNIT 1:
Introduction: Introduction to Computer Security, Threats, Harms, Vulnerabilities, Authentication, Access Control and Cryptography, Authentication, Access Control, Cryptography, Unintentional (Non-malicious) Programming Oversights, Malicious Code—Malware, Countermeasures

[8hrs]

UNIT 2:
Web Security: User Side, Browser Attacks, Web Attacks Targeting Users, Obtaining User or Website Data, Email Attacks

[6hrs]

UNIT 3:

Operating Systems Security: Security in Operating Systems, Security in the Design of Operating Systems, Rootkit

[6hrs]

UNIT 4:

Network and Cloud Security: Network Concepts, Threats to work Communications, Wireless Network Security, Denial of Service, Distributed Denial-of-Service Strategic Defenses: Security Countermeasures, Cryptography in Network Security, Firewalls, Intrusion Detection and Prevention Systems, Network Management, Cloud Computing Concepts, migrating to the Cloud, Cloud Security Tools and Techniques, Cloud Identity Management, Securing IaaS

[10hrs]

UNIT 5:

Privacy: Privacy Concepts, Privacy Principles and Policies, Authentication and Privacy, Privacy on the Web, Email Security

Management and Incidents: Security Planning, Business Continuity Planning, Handling Incidents, Risk Analysis, Dealing with Disaster

Legal Issues and Ethics: Protecting Programs and Data, Information and the Law, Rights of Employees and Employers, Issues related to Software Failures, Ethical Issues in Computer Security, Incident Analysis with Ethics

[10hrs]

Course Outcomes: At the end of the course the student should be able to:

CO 1: Understand the broad set of technical, social & political aspects of Cyber Security and security management methods to maintain security protection

CO2: Appreciate the vulnerabilities and threats posed by criminals, terrorist and nation states to national infrastructure

CO3: Understand the nature of secure software development and operating systems

CO4: Recognize the role security management plays in cyber security defense and legal and social issues at play in developing solutions.

CO5: Understand the concepts related to Security and Privacy.

Text Books:

1. Pfleeger, C.P., Security in Computing, Prentice Hall, 2010, 5th edition.
2. Schneier, Bruce. Applied Cryptography, Second Edition, John Wiley & Sons, 1996.

Reference Books:

1. Rhodes-Ousley, Mark. Information Security: The Complete Reference, Second Edition, Information Security Management: Concepts and Practice. New York, McGraw-Hill, 2013.
2. Whitman, Michael E. and Herbert J. Mattord. Roadmap to Information Security for IT and Infosec Managers. Boston, MA: Course Technology, 2011

Course Code:BTCS604-18UC	Course Title: Compiler Design Lab	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Write a program to design a Lexical Analyzer(LA) for a given language.
2. Write a program to implement the Lexical Analyzer using lex tool.
3. Write a program to design Predictive Parser (Non Recursive Descent parser) for a given language.
4. Write a program for constructing of LL (1) parsing.
5. Write a program for constructing recursive descent parsing.
6. Write a program to design and implement an LALR bottom up Parser for checking the syntax of the statements in a given language.
7. Write a program to implement operator precedence parsing.
8. Convert the BNF rules into Yacc form and write code to generate abstract syntax tree.
9. Write a program to generate machine code from the abstract syntax tree generated by the parser.

10. write a program to implement simple code optimization technique.
11. Write a program to generation of Code for a given Intermediate Code.

Suggested Tools – Lex, Yacc

Course Code: BTCS605-18UC	Course Title: Artificial Intelligence Laboratory	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Write a program for A* Algorithm.
2. Write a program for Depth First Search.
3. Write a program for Breadth First Search.
4. Write simple fact for the statements using PROLOG.
5. Write predicates one converts centigrade temperatures to Fahrenheit, the other checks if a temperature is below freezing.
6. Write a program in prolog for medical diagnosis and show the advantage and disadvantage of green and red cuts.
7. Write a program to implement tower of honoi.
8. Write a program to solve traveling salesman problem.

9. Write a program for expert system using forward chaining.

Course Code: BTCS609-18UC	Course Title: Network Security and Cryptography Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

Task 1: What do you mean by a packet sniffer? What is its purpose? Explore from the Internet some popular packet sniffers. Wireshark is one such sniffer. Install Wireshark on your system. Explore its features and sniff various packets from your machine and enter into your machine. Identify the type of protocols of these packets. Connect to the PTU's website and find HTTP, TCP, IP and data link layer headers. Take snapshot of header fields, values and payloads of the packets being exchanged between your machine and PTU's website. **(CO 1)**

Task 2: Explore socket programming in C/python/java or any other technology/API for the purpose. Write a program to encrypt (using Ceaser cipher) your given plaintext into ciphertext at the client's machine and send the ciphertext using socket to server machine. Server should receive the ciphertext and transform it back to plaintext. Display plaintext at server's machine. **(CO 2)**

Task 3: Implement DES algorithm. Display all substitution and transposition outputs. **(CO 2)**

Task 4: Implement concept of digital envelop using socket programming. **(CO 2)**

Task 5: Write a program to implement RSA algorithm. **(CO 2)**

Task 6: Write a program to implement Diffie Hellman key exchange algorithm. Implement Man in the Middle attack. **(CO 2)**

Task 7: Explore various hash functions. Use these hash functions to generate digital signatures on different length messages. **(CO 3)**

Task 8: Design a secure message exchange system for PTU. Carefully identify the requirements and implement using socket programming. **(CO 3)**

Task 9: Install packet sniffer on your machine. Visit any https website. Take snapshots of TCP headers of all phases of SSL/TLS protocol. Demonstrate and explain working of SSL/TLS protocol with the help of snapshots. **(CO 1)**

Course Code: BTCS610-18UC	Course Title: Data Mining Lab	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Introduction to WEKA using JAVA.

2. To Perform data preprocessing tasks and Demonstrate performing association rule mining on data sets

3. Demonstrate performing clustering on data sets

4. Implementing SVM on real world problems.

5. Write a program to construct an optimized DECISION TREE for a given training data and by using any attribute selection measure.

6. Write a program for NAÏVE BAYESIAN algorithm for classifying the data.

7. Implement the K-Means Clustering algorithm for clustering the given data.

Suggested Tools- WEKA, Orange

Course Code: BTCS611-18UC	Course Title: Cloud Computing Lab	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Install Virtualbox/VMware Workstation with different flavours of linux or windows OS on top of windows7 or 8.
2. Install a C compiler in the virtual machine created using virtual box and execute Simple Programs
3. Installation of any open source tool. Create hello world app and other simple web applications using python/java.
4. Use of any open source tool for web applications using Saas.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Find a procedure to launch virtual machine using trystack (Online Openstack Demo Version)
8. Instructor may use CloudSim Architecture(User code, CloudSim, GridSim, SimJava)

Suggested Tools - CloudStack, FOSS-Cloud, Docker

Course Code: BTCS615-18UC	Course Title: Information Theory and Coding Lab	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Write a program for determination of various entropies and mutual information of a given channel. Test various types of channel such as a) Noise free channel. b) Error free channel c) Binary symmetric channel d) Noisy channel Compare channel capacity of above channels
2. Write a program for generation and evaluation of variable length source coding using C/MATLAB (Any 2) a) Shannon – Fanocodingand decoding b) Huffman Coding and decoding c) Lempel Ziv Coding and decoding
3. Write a Program for coding & decoding of Linear block codes
4. Write a Program for coding & decoding of Cyclic codes.
5. Write a program for coding and decoding of convolutional codes
6. Write a program for coding and decoding of BCH and RS codes
7. Write a simulation program to implement source coding and channel coding for transmitting a text file

Suggested Tools - Implementation can be done in C/C++/ MATLAB

Course Code: BTCS616-18UC	Course Title: Data Science Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

1. Write a program for data preprocessing by using jupyter notebooks.
2. Write a program for data manipulation by using jupyter notebooks.
3. Write a program for counting a frequency of particular element in python.
4. Write any program for using numpy.
5. Write a program for using aggregation function.
6. Write a program for using sorting of an array using numpy.
7. Write any program for using pandas library.
8. Write any program for handling missing data using pandas library.
9. Write a program for concatenating and appending, combining datasets
10. Write a program for vectorizing string operations.
11. Write a basic program for using matplotlib library.
12. Write a program for simple line plots, simple scatter plots, visualizing errors density and contour plots by using matplotlib library.
13. Write a simple program for using scikit application.
14. Write a machine learning model that classify the data by using naive bayes classification

15. Write a machine learning model that classify the data by using linear regression.
16. Write a machine learning model that classify the data by using k-means clustering

Suggested Tools - Anaconda, PyCharm, Apache Spark, Spyder etc.

Course Code: BTCS617-18UC	Course Title: Soft Computing Lab	0L:0T:2P	1 Credits

Detailed List of Tasks:

1. Create a perceptron with appropriate no. of inputs and outputs. Train it using fixed increment learning algorithm until no change in weights is required. Output the final weights
2. Create a simple ADALINE network with appropriate no. of input and output nodes. Train it using delta learning rule until no change in weights is required. Output the final weights.
3. Train the auto correlator by given patterns: A1=(-1,1,-1,1), A2=(1,1,1,-1), A3=(-1, -1, - 1, 1). Test it using patterns: Ax=(-1,1,-1,1), Ay=(1,1,1,1), Az=(-1,-1,-1,-1).
4. Train the hetro correlator using multiple training encoding strategy for given patterns: A1=(000111001) B1=(010000111), A2=(111001110) B2=(100000001), A3=(110110101) B3(101001010). Test it using pattern A2.
5. Implement Union, Intersection, Complement and Difference operations on fuzzy sets. Also create fuzzy relation by Cartesian product of any two fuzzy sets and perform maxmin composition on any two fuzzy

relations.

6. Solve Greg Viot’s fuzzy cruise controller using MATLAB Fuzzy logic toolbox
7. Solve Air Conditioner Controller using MATLAB Fuzzy logic toolbox
8. Implement TSP using GA

Suggested Tools - MATLAB

Seventh Semester

Course Code: BTCS 701-18UC	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)

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

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: BTCS703-18UC	Course Title: Machine Learning Lab	L:0 T:0 P:2	1Credits

Detailed List of Tasks:

1. Implement data pre-processing
2. Deploy Simple Linear Regression
3. Simulate Multiple Linear Regression
4. Implement Decision Tree
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: BTCS704-18UC	Course Title: Quantum Computing	3L: 0T: 0P	3 Credits

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.

<u>Text books:</u>

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: BTCS707-18UC	**Course Title:** Quantum Computing Lab	**L:0 T:0 P:0**	**1 Credits**

Detailed List of Tasks:

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.

Course Code: BTCS 705-18UC	Course Title: Big Data Analytics	L:3 T:0 P:0	3 Credits

Detailed Contents:

Introduction: Big Data Overview, The rising and importance of data sciences, Big data analytics in industry verticals

Hadoop Architecture: Hadoop Architecture, Hadoop ecosystem components, Hadoop Storage: HDFS, Hadoop Processing: MapReduce Framework, Hadoop Server Roles

Data Analytics Lifecycle and methodology: Business Understanding, Data Understanding, Data Preparation, Modeling, Evaluation, Communicating results, Deployment, Data exploration & preprocessing

Data Analytics - Theory & Methods: Measures and evaluation, Supervised learning, Linear/Logistic regression, o Decision trees, Naïve Bayes, Unsupervised learning, K-means clustering, Association rules, Unstructured Data Analytics, Technologies & tools, Text mining, Web mining

The Endgame: Opertionalizing an Analytics project, Data Visualization Techniques, Creating final deliverables

Text Books:

1. Hadoop: The Definitive Guide by Tom White
2. Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph by David Loshin
3. Machine Learning by Tom M. Mitchell

Course Code: BTCS 708-18UC	Course Title: Big Data Analytics Lab	L:0 T:0 P:2	1 Credits

List of Experiments:

1. Hands-on with Map Reduce: Hadoop, Hive, MapR
2. Hands-on with NoSQL Databases: S3, Hadoop Distributed File System(HDFS)
3. Hands-on with Statistical Packages
4. Hands-on with Visual Data Analysis tools

Course Code: BTCS706-18UC	Course Title: Speech and Natural Language Processing	3L:0 T: 0P	Credits: 3

OBJECTIVE: To tag a given text with basic Language processing features, design an innovative application using NLP components, implement a rule based system to tackle morphology/syntax of a Language, design a tag set to be used for statistical processing keeping an application in mind, design a Statistical technique for a new application, Compare and contrast use of different statistical approaches for different types of applications.

Detailed Contents:

UNIT I INTRODUCTION

Natural Language Processing tasks in syntax, semantics, and pragmatics – Issues - Applications - The role of machine learning - Probability Basics –Information theory – Collocations -N-gram Language Models - Estimating parameters and smoothing - Evaluating language models.

UNIT II MORPHOLOGY AND PART OF SPEECH TAGGING

Linguistic essentials - Lexical syntax- Morphology and Finite State Transducers - Part of speech Tagging - Rule-Based Part of Speech Tagging - Markov Models - Hidden Markov Models – Transformation based Models - Maximum Entropy Models. Conditional Random Fields

UNIT III SYNTAX PARSING

Syntax Parsing - Grammar formalisms and treebanks - Parsing with Context Free Grammars - Features and Unification -Statistical parsing and probabilistic CFGs (PCFGs)-Lexicalized PCFGs.103

UNIT IV SEMANTIC ANALYSIS

Representing Meaning – Semantic Analysis - Lexical semantics –Word-sense disambiguation - Supervised – Dictionary based and Unsupervised Approaches - Compositional semantics[1]Semantic Role Labeling and Semantic Parsing – Discourse Analysis.

UNIT V APPLICATIONS

Named entity recognition and relation extraction- IE using sequence labeling-Machine Translation (MT) - Basic issues in MT-Statistical translation-word alignment- phrase-based translation – Question Answering.

Text Books:

1. Daniel Jurafsky and James H. Martin. 2009. Speech and Language Processing: An Introduction to Natural Language Processing, Speech Recognition, and Computational Linguistics. 2nd edition. Prentice-Hall.

2. Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language Processing. MIT Press.

Course Code: BTCS706-18UC	**Course Title: Speech and Natural Language Processing**	**0L:0 T: 2P**	**Credits: 1**

Objectives: To describe the techniques and algorithms used in processing (text and speech) natural languages.

SECTION-A Introduction: Motivation for studying NLP; Introduction to NLP, Language Structure and Analyzer - Overview of language, requirement of computational grammar. Natural Language Processing as the forcing function of AI Words and Word Forms: Morphology fundamentals; Morphological Diversity of Indian Languages; Morphology Paradigms; Finite State Machine Based Morphology; Automatic Morphology Learning; Shallow Parsing; Named Entities; Maximum Entropy Models; Random Fields, Scope Ambiguity and Attachment Ambiguity resolution. Structures: Theories of Parsing, Parsing Algorithms; Robust and Scalable Parsing on Noisy Text as in Web documents; Hybrid of Rule Based and Probabilistic Parsing; Scope Ambiguity and Attachment Ambiguity resolution.

SECTION-B Machine Translation: Need of MT, Problems of Machine Translation, MT Approaches, Direct Machine Translations, Rule-Based Machine Translation, Knowledge Based MT System, Statistical Machine Translation, UNL Based Machine Translation, Translation involving Indian Languages. Meaning:

Lexical Knowledge Networks, WorldNet Theory; Indian Language Word Nets and Multilingual Dictionaries; Semantic Roles; Word Sense Disambiguation; WSD and Multilinguality; Metaphors. Speech Recognition: Signal processing and analysis method, Articulation and acoustics, Phonology and phonetic transcription, Word Boundary Detection; Argmax based computations; HMM and Speech Recognition.
Reference Books: 1. James A., Natural language Understanding 2e, Pearson Education, 1994 2. Bharati A., Sangal R., Chaitanya V.. Natural language processing: a Paninian perspective, PHI, 2000 3. Siddiqui T., Tiwary U. S.. Natural language processing and Information retrieval, OUP, 2008 4. Jurafsky, Dab and Martin, James, Speechand Language Processing, Second Edition, Prentice Hall, 2008.

List of Experiments:

1. Write a program for word analysis
2. Write a program for word generation
3. Write a program for morphology study
4. Write an program for POS tagging using hidden markov model
5. Write an program for building chunker

Course Code: BTCS710-18UC	Course Title: Block Chain Technology	3L:0 T: 0P	Credits: 3

Detailed Contents:

UNIT: I 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

UNIT: II 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

UNIT: III 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

UNIT: VI 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

UNIT: V 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

UNIT: IV BLOCKCHAIN APPLICATIONS

Internet of Things-Medical Record Management System-Block chain in Government and Block chain Security-Block chain Use Cases –Finance

<u>COURSE OUTCOMES</u>

CO1: Understand emerging abstract models for Block chain Technology.

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.

<u>Text Books:</u>

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: BTCS713-18UC	Course Title: Block chain Technology Lab	L:0 T:0 P:2	Credits:1

List of Experiments:

1. To Develop Naive Block chain construction.
2. Design Memory Hard algorithm and its Implementation
3. Design Toy application using Blockchain
4. Program to Solve a Mining puzzles using Block chain
5. The ability to formulate mathematical models and problem-solving skills through programming techniques for addressing real-time problems using appropriate data structures and algorithms.
6. 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.
7. 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: BTCS711-18UC	**Course Title : Software Defined Networking**	**3L:0T:0P**	**3Credits**

Course Prerequisites:

Computer networks or related courses., C, C++, Java, or Python programming skills, Basic Linux operating system skills.

Course Objectives:

This course introduces software defined networking, an emerging paradigm in computer networking that allows a logically centralized software program to control the behavior of an entire network. Recently, SDN is being deployed in data center networks, campus networks, enterprise networks, operator networks, and is expected to play a very important role in Internet of Things (IoT) networks and 5G cellular networks. In this course, we will first introduce the concepts of SDN, its use cases and its applications to give the students an overall picture of this new technology.

Course Outcomes:

I. To define and understand terminology involved in the field of software defined networking (SDN).

II. To describe software defined architecture and open flow protocol for communication between controller and switches.
III. To provide an overview and comparison of various SDN controllers.
IV. To design topologies using Mininet and various APIs.
V. To develop various applications and protocols for SDN architecture.
VI. To identify and analyse various security threats in SDN based networks.

Detailed Contents:

UNIT I:

Overview of Software Defined Networking: History and Evaluation of SDN**,** Introduction to SDN, Advantages of SDN over Traditional Network Architecture, Separation of Control and Data Plane, Use Cases of SDN.

[6hrs] (CO 1)

UNIT II:

SDN Components

How SDN Works - SDN Architecture: Data plane, Control plane, Application Plane, Southbound Interface, Northbound Interface, Pure and Hybrid openflow switches, Software and Hardware based Openflow switches, Programmable Network Hardware.

[6hrs] (CO 2)

SDN Controllers: Overview, Centralized & Distributed Controllers, Open source SDN Controllers: POX , Ryu, Floodlight, OpenDaylight, Advantages and Disadvantages of each controller**.**

[5hrs] (CO 3)

UNIT III:

OpenFlow Protocol

OpenFlow Overview- OpenFlow 1.0 and OpenFlow Basics- , OpenFlow 1.1 Additions, OpenFlow 1.2 Additions, OpenFlow 1.3 Additions, Flow table components: matching rules, Actions, Counters, OpenFlow security, Proactive and reactive approach to insert flow table entries, Comparison of Openflow with other Southbound interfaces, OpenFlow Limitations.

[6hrs] (CO 2)

UNIT IV:

Mininet Emulation Tool

Creating Default & Custom topologies in Mininet using low level API, mid-level API, high level API, Developing Switching and Firewall Applications in Mininet.

[6hrs] (CO 4)

UNIT V:

Programming SDN: Northbound Application Programming Interface, Current Languages and Tools, Composition of SDNs.

[5hrs] (CO 5)

SDN Security Challenges and Issues Characteristics of SDN, Security Analysis and Potential attacks in SDN, Solutions to the security issues in SDN.

[5hrs] (CO 6)

UNIT VI:

Software Defined Networks with Network Function Virtualization (NFV)

Introduction to Network Function Virtualization, History and Evaluation of NFV, NFV Architecture and its relation with SDN, Similarities and differences in SDN and NFV, NFV use cases.

[6hrs] (CO 1)

Text Books:

1. SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies. By Thomas D. Nadeau, Gray Publisher: O'Reilly Media, August 2013, ISBN: 97814493-4230-2, ISBN 10:1-4493-4230-2.
2. Software Defined Networks: A Comprehensive Approach by Paul Goransson and Chuck Black, Morgan Kaufmann, June 2014, Print Book ISBN: 9780124166752, eBook ISBN : 9780124166844.

Suggested Books:

1. Software Defined Networking with OpenFlow., Siamak Azodolmolky, Packt Publishing, 2013.
2. Software Networks: Virtualization, SDN, 5G, Security., Guy Pujolle, Wiley, 2015.
3. Foundations of Modern Networking: SDN, NFV, QoE, IoT, and Cloud, William Stallings Publisher: Addison-Wesley 2015 ISBN: 9780134175393, William Stallings Publisher.

Course Code: BTCS714-18UC	**Course Title: Software Defined Networking Lab**	**L:0 T:0 P:2**	**1 Credits**

Detailed List of Tasks:

1. Installation of Mininet emulation tool in Virtual Box.
2. Build different topologies(single, reversed, linear, tree) using the Mininet CLI.
3. Insert, delete and modify flow entries in sdn switches using ovs-ofctl.
3.Create custom toplogies in mininet using low-level API.
4.Create custom toplogies in mininet using mid-level API.
5.Create custom toplogies in mininet using high-level API.
6. Connect mininet network with a remote controller.
7.Create and run hub application using pox controller.
8. Create and run switch application using pox controller

Course Code: BTCS712-18UC	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.

Text 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: BTCS715-18UC	**Course Title: Digital Image Processing Lab**	**L:0 T:0 P:2**	**1 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: BTCS717-18UC	**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: BTCS718-18UC	Course Title: Symbolic Logic & Logic Processing	3L: 0T: 0P	Credits: 3

Detailed Contents:

UNIT-I

Prepositional Logic: syntax and semantics: Validity and consequence. Normal forms. Representing world knowledge using prepositional logic. First Order Logic: World knowledge representation and the need for quantifiers. Syntax, semantics validity consequence clause normal form.

UNIT-II

Introduction to Prolog: Syntax of Prolog, Structured data representation. Execution model Introduction to Programming in Prolog, Illustrative examples. The Connection Between Logic and Logic Programming: Interpreting logic programs in terms of Horn clauses Deduction from clause form formulas resolution for prepositional logic Ground resolution. Unification and first order resolution SLD resolution; the computation and search rules. SLD trees and interpretation of non-declarative features of Prolog.

UNIT-III

Advanced Prolog Features: Programming Techniques: Structural Induction and Recursion, Extra Logical features: Cut and Negation Case Studies. Introduction to Fuzzy logic and neural networks.

Texts Books:

1. Gries, The Science of Programming, Narosa Publishers, 1985.

2. Stoll, Set Theory and Logic, Dover Publishers, New York, 1963.

3. Clocksin, W.F. and Mellish, C.S., Programming in Prolog 2nd Edition, Springer - Verlag, 1984.

4. O'Keefe, R., The Craft of Prolog. The MIT Press, 1991.

5. Lloyd, J. W., Foundation of Logic Programming, Springer, 1984.

Scheme of

Bachelor of Technology

Computer Science & Engineering

Batch 2019 onwards

(3rd - 8th Semester)

for University campuses

By

Department of Academics

IK Gujral Punjab Technical University

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	1	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	4	1	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	60	40	100	Satisfactory/Un satisfactory
Total			**15**	**3**	**12**	**380**	**420**	**800**	**21**

*Syllabus to be decided by respective institute internally. It may include latest technologies.

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	1	0	40	60	100	3
BTCS 402-18	Professional Core Courses	Operating Systems	3	1	0	40	60	100	3
BTCS 403-18	Professional Core Courses	Design & Analysis of Algorithms	3	1	0	40	60	100	3
HSMC 122-18	Humanities & Social Sciences including Management Courses	Universal Human Values-II	2	1	0	40	60	100	3
EVS101-18	Mandatory Courses	Environmental Sciences	1	-	-	-	-	-	0
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**	**5**	**10**	**290**	**360**	**650**	**21**

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**	**460**	**440**	**900**	**23**

* 4-6 weeks industrial training undertaken after 4th semester in summer vacations.

Sixth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
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**

Seventh 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**

Eighth Semester

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
BTCS 801-18	Semester Training	300	200	500	16

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

BTCS TTT-18: Elective-V

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

Open electives offered by the department:

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

Third Semester

Course Code: BTCS301-18	**Course Title:** Data Structure & Algorithms	**3L:1T: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; &
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, Copy constructors, 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 & Algorithms Lab	**0L:0T:4P**	**2Credits**

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:

- Insertion at beginning
- Insertion at end
- Insertion after a given node
- Traversing a linked list

Task 11: Write a menu driven program to perform following deletion operations in a single linked list:

- Deletion at beginning
- Deletion at end
- 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 usingBFS.

Task 20: Program to traverse graphs usingDFS.

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**

List of Experiment:

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.

Course Code: BTAM304-18	**Course Title:** 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 most branches 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 solve engineering problems related to convergence, infinite series, power series and Taylor series;
4. Create, select and utilize the learnt techniques of first degree ordinary differential equations to 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.

Development of Societies Course code: HSMC101-18

Credits: 3

COURSE TOPIC

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 couldbe

a) Interact with local communities and understand theirissues.

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.

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 IndianPhilosophy.
c. Greek Philosophy:

2.2 Unit 2:
Origin of the Universe:
- NasidiyaSukta: "Who reallyknows?"
- Brhadaranyaka Upanishad; Chandogya Upanishad: Non-self, Self, real and unreal.
- Taittiriya Upanishad: SikshaValli.
- Plato's Symposium: Lack as the source of desire andknowledge.
- 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

1. Copleston, Frederick, History of Philosophy, Vol. 1.Great Britain: Continuum.
2 Hiriyanna, M. Outlines of Indian Philosophy, Motilal Banarsidass Publishers; Fifth Reprint edition (2009)

3 Sathaye, Avinash, Translation of Nasadiya Sukta
4. Ralph T. H. Griffith. The Hymns of the Ṛgveda. Motilal Banarsidass: Delhi: 1973.
5. Raju, P. T. Structural Depths of Indian Thought, Albany: State University of New York Press.
6. Plato, Symposium, Hamilton Press.
7. Kautilya Artha 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 Madhyastha Darshan.

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:

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 HillPublishing CompanyLimited, 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**, PearsonEducation.
6. Ghosal, Digital **Electronics**, Cengage Learning.

Course Code:BTES302-18	Course Title: Digital Electronics Lab	0L:0T:2P	1Credits

List of Experiments:

Task 1: To verify the Truth-tables of all logic gates.

Task 2: To realize and verify the Half & full adder circuits using logic gates.

Task 3: To realize Half & full subtractor circuits using logic gates.

Task 4: To realize Encoder and Decodercircuits

Task 5: To realize Multiplexer circuits

Task 6: To realize 4-bit binary-gray & gray-binaryconverters.

Task 7: To realize comparator circuit for two binary numbers of 2-bit each.

Task 8: To realize Full adder & full subtractor circuits using encoder.

Task 9: To design Full adder & full subtractor circuits using multiplexer.

Task 10: To design and verify the Truth tables of all flip-flops.

Task 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

Fourth Semester

Course Code: BTES401-18	**Course Title:** Computer Organization & Architecture	**3L:1T: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-and add, 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 parallel processors, 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 Writing assembly 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. "Computer Organization and Architecture", Moris Mano,
2. "Computer Organization 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.

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Course Code: BTCS402-18	**Course Title:** Operating Systems	**3L:1T: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, Strict Alternation, Peterson's Solution, The Producer\Consumer Problem, Semaphores, Event Counters, 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: Memory Management
Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation –Fixed and variable partition–Internal and 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, Allocation methods (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 Avi Silberschatz, 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

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Course Code: BTCS403-18	**Course Title:** Design and Analysis of Algorithms	**3L:1T: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.

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, Udi Manber, Addison-Wesley, Reading, MA.

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Course Code: BTES402-18	**Course Title:** Computer Organization & Architecture Lab	**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 Microcontrollers by B. Ram, Dhanpat Rai Publications.

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.

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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 Experiential Validation- 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 inharmony 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 Prosperityin detail
12. Programs to ensure Sanyam 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 ofrelationship.

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 inrelationship.
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 innature
20. Understanding Existence as Co-existence of mutually interacting units in all- pervasive space
21. Holistic perception of harmony at all levels ofexistence.
    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 people friendly and eco - friendly production systems, c. Ability to identify and develop appropriate technologies 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: Ek Parichaya, A. Nagaraj, Jeevan Vidya Prakashan, 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.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj –Pandit Sunderlal
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.

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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 resources 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
a) Introduction – Definition: genetic, species and ecosystem diversity.
b) Biodiversity at global, National and local levels.
c) India as a mega-diversity nation
d) Hot-sports of biodiversity.
e) Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
f) Endangered and endemic species of India

Module 4: Social Issues and the Environment
a) From Unsustainable to Sustainable development
b) Resettlement and rehabilitation of people; its problems and concerns.
c) Environmental ethics: Issues and possible solutions.
d) Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies.
e) 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
j) To work in kitchen garden for mess
k) To know about the different varieties of plants
l) Shutting down the fans and ACs of the campus for an hour or so
m) Visit to a local area to document environmental assets river/forest/grassland/hill/mountain/lake/Estuary/Wet lands
n) Visit to a local polluted site- Urban/Rural/Industrial/Agricultural n) Visit to a Wildlife sanctuary, National Park or Biosphere Reserve

<u>Suggested Readings</u>

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,
15. 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.
5. 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:
- Nasidiya Sukta: "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.
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 livedexperience can be considered.

Course Code:BTCS401-18	**Course Title:** 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

Suggested books:

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
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, Tata Mcgraw-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

Course Code: BTCS501-18	**Course Title:** Database Management Systems	**3L:0T:0P**	**3Credits**

Detailed Contents:

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)

Course Outcomes:

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:

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)

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:
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.

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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.

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:

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.

List of Experiments:

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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cCourse 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
  - 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**

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:

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.
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

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**

List of Experiments:

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 subject.

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**

Detailed Contents:

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

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

ELECTIVE II

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

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.

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Course Code: BTCS 607-18	**Course Title:** 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

Detailed Contents:

UNIT1: **Introduction** : Definition of cloud, characteristics of cloud, historical developments & challenges

Course Code: BTCS 612-18	Course Title: Cloud Computing	3L:0T:0P	3Credits

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)

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.
- 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 616-18	**Course Title : Data Science**	**3L:0T:0P**	**3Credits**

Detailed Contents:

UNIT 1: Introduction
Introduction to Data Science , Evolution of Data Science , Data Science Roles , Stages in a Data Science Project, Applications of Data Science in various fields, Data Security Issues.

[8hrs] (CO 1)

UNIT 2: Data Collection and Data Pre-Processing
Data Collection Strategies, Data Pre-Processing Overview, Data Cleaning, Data Integration and Transformation, Data Reduction, Data Discretization.

[9hrs] (CO 2)

UNIT 3: Exploratory Data Analytics
Descriptive Statistics, Mean, Standard Deviation, Skewness and Kurtosis , Box Plots, Pivot Table, Heat Map, Correlation Statistics , ANOVA.

[6hrs] (CO 2)

UNIT 4: Model Development
Simple and Multiple Regression, Model Evaluation using Visualization , Residual Plot, Distribution Plot, Polynomial Regression and Pipelines, Measures for In-sample Evaluation, Prediction and Decision Making.

[6hrs] (CO 3)

UNIT 5 Model Evaluation
Generalization Error, Out-of-Sample Evaluation Metrics, Cross Validation, Overfitting, Under Fitting and Model Selection, Prediction by using Ridge Regression, Testing Multiple Parameters by using Grid Search.

[6hrs] (CO 4)

Course Outcomes:

After undergoing this course, the students will be able to:

CO1: understand of the basics of the ethical use of data science
CO2: Build skills in transformation and merging of data for use in analytic tools
CO3: Perform linear and multiple linear regression analyses.
CO4: Evaluate outcomes and make decisions based on data

Suggested Readings/ Books:

1. Jojo Moolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016.
2. Cathy O'Neil and Rachel Schutt , "Doing Data Science", O'Reilly, 2015.
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013.
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global

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Course Code: BTCS 617-18	Course Title : Data Science Lab	0L:0T:2P	1Credits

Detailed List of Tasks:

1. Creating and displaying Data. and Matrix manipulations
2. Creating and manipulating a List and an Array
3. Creating a Data Frame and Matrix-like Operations on a Data Frame
4. Merging two Data Frames and Applying functions to Data Frames
5. Visualization Effects
6. Plotting with Layers
7. Overriding Aesthetics
8. Histograms and Density Charts
9. Simple Linear Regression – Fitting, Evaluation and Visualization
10. Multiple Linear Regression, Lasso and Ridge Regression

Suggested Tools – Python, R

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)

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
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

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, broadcast receivers, data components
7. Using emulator to deploy and run mobile apps
8. Testing mobile app- unit testing, black box testing and test automation

Seventh / Eighth 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:

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

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:

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**

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**

COURSE OUTCOMES

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.

References:

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**

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)**

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:

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

ELECTIVE V

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

COURSE OUTCOMES

CO1: Understand emerging abstract models for Block chain Technology.

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)**

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.

Scheme & Syllabus of

Bachelor of Technology

Software Engineering

Batch 2019 onwards

By

Department of Academics

IK Gujral Punjab Technical University

Bachelor of Technology in Software Engg.

It is a Graduate (UG) Programme of 4 years duration (8 semesters)

Courses & Examination

First Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
SE 1110	Engineering Science Course	Programming for Engineers 1	3	0	0	40	60	100	2
EP 1150	Basic Science Course	Physics for Engineers 1	3	0	0	40	60	100	2
EP 1700	Engineering Science Course	Engineering Mechanics 1	3	1	0	40	60	100	3
EP 1990	Engineering Science Course	Introduction to Engineering Measurements	3	1	0	40	60	100	2
MA 1130	Basic Science Course	Enriched Calculus 1	3	2	0	40	60	100	3
MA 1300	Basic Science Course	Linear Algebra for Engineers	3	2	0	40	60	100	3
SE 1110P	Engineering Science Course	Programming for Engineers 1 Lab	0	0	2	30	20	50	1
EP 1150P	Basic Science Course	Physics for Engineers 1 Lab	0	0	2	30	20	50	1
Total			**18**	**6**	**4**	**420**	**280**	**700**	**17**

Second Semester

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
SE 1210	Engineering Science Course	Programming for Engineers 2	3	0	0	40	60	100	2
EP 1250	Basic Science Course	Physics for Engineers 2	3	0	0	40	60	100	2
MA 1230	Basic Science Course	Enriched Calculus 2	3	2	0	40	60	100	3
MA 1700	Engineering Science Course	Discrete Mathematics	3	1	0	40	60	100	3
CH 1520	Basic Science Course	Principles of Chemistry	3	0	3	40	60	100	3
DR 1520	Engineering Science Course	Engineering Graphics	2	0	3	40	60	100	3
SE 1210P	Engineering Science Course	Programming for Engineers 2 Lab	0	0	2	30	20	50	1
EP 1250P	Basic Science Course	Physics for Engineers 2 Lab	0	0	3	30	20	50	1
Total			**17**	**3**	**11**	**420**	**280**	**700**	**18**

Third Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTES301-18	Engineering Science Course	Digital Electronics	3	0	0	40	60	100	3
SE301-19	Professional Core Courses	Data structure & Algorithms	3	1	0	40	60	100	3
SE302-19	Professional Core Courses	Computer Networks	3	1	0	40	60	100	3
SE303-19	Professional Core Courses	Software Engineering	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
BTES302-18	Engineering Science Course	Digital Electronics Lab	0	0	2	30	20	50	1
SE304-19	Professional Core Courses	Data structure & Algorithms Lab	0	0	4	30	20	50	2
SE305-19	Professional Core Courses	Computer Networks lab.	0	0	2	30	20	50	1
SE306-19	Professional Core Courses	Software Engineering lab.	0	0	2	30	20	50	1
SE307-19	Professional Core Courses	IT Workshop*	0	0	2	30	20	50	1
		Summer Institutional Training	0	0	0	60	40	100	Satisfactory/Unsatisfactory
Total			**14**	**3**	**12**	**410**	**440**	**850**	**21**

*Syllabus to be decided by respective institute internally. It may include latest technologies.

Fourth Semester

Course Code	Type of Course	Course Title	Hours per Week L	T	P	Marks Distribution Internal	External	Total Marks	Credits
SE401-19	Professional Core Courses	Database Management system	3	0	0	40	60	100	3
SE402-19	Engineering Science Course	Computer Organization & Architecture	3	1	0	40	60	100	3
SE403-19	Professional Core Courses	Operating Systems	3	1	0	40	60	100	3
SE404-19	Professional Core Courses	Design & Analysis of Algorithms	3	1	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
SE405-19	Engineering Science Course	Database Management system Lab	0	0	4	30	20	50	2
SE406-19	Engineering Science Course	Computer Organization & Architecture Lab	0	0	2	30	20	50	1
SE407-19	Professional Core Courses	Operating Systems Lab	0	0	2	30	20	50	1
SE408-19	Professional Core Courses	Design & Analysis of Algorithms Lab	0	0	4	30	20	50	2
		Total	**14**	**4**	**12**	**320**	**380**	**700**	**21**

There will be 4-6 weeks summer industrial training after 4th sem.

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
SE501-19	Professional Core Courses	Agile Software Development	3	0	0	40	60	100	3
BTCS 502-18	Professional Core Courses	Formal Language & Automata Theory	3	0	0	40	60	100	3
SE502-19	Professional Core Courses	Software Testing and Quality Assurance	3	0	0	40	60	100	3
SE XXX-18	Professional Elective	Elective-I	3	0	0	40	60	100	3
EVS101-18	Mandatory Courses	Environmental Sciences	3	-	-	100	-	100	S/US
MC	Mandatory Courses	Constitution of India/ Essence of Indian Traditional Knowledge	2	-	-	100	-	100	S/US
SE503-19	Professional Core Courses	Agile Software Development Lab	0	0	4	30	20	50	2
SE 506-18	Professional Core Courses	Software Testing and Quality Assurance 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	8	550	400	950	19

* 4-6 weeks industrial training undertaken after 4th semester in summer vacations.

Sixth Semester

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
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**

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

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

LIST OF COURSES FOR HONOURS DEGREE

In order to have an Honours degree, a student choose 18-20 credits from the following courses in addition.

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
BTCS H01-18	Professional Elective Courses	Graph Theory	3	0	0	40	60	100	3
BTCS H02-18	Professional Elective Courses	Computer Vision	3	0	0	40	60	100	3
BTCS 611-18	Professional Elective Courses	Embedded Systems	3	0	0	40	60	100	3
BTCS H03-18	Professional Elective Courses	Software Project Management	3	0	0	40	60	100	3
BTCS H04-18	Professional Elective Courses	Cryptography & Network Security	3	0	0	40	60	100	3
BTCS H05-18	Professional Elective Courses	Internet-of-Things	3	0	0	40	60	100	3
BTCS 804-18	Professional Elective Courses	Data Analytics	3	0	0	40	60	100	3
BTCS 608-18	Professional Elective Courses	Machine Learning	3	0	0	40	60	100	3
BTCS H06-18	Professional Elective Courses	ICT in Agriculture and Rural Development	3	0	0	40	60	100	3
BTCS H07-18	Professional Elective Courses	Computational Technologies for Smart Cities	3	0	0	40	60	100	3
BTCS H08-18	Professional Elective Courses	Computer Forensics	3	0	0	40	60	100	3

Third Semester

Course Code: SE301-19	Course Title: Data Structure & Algorithms	3L:1T:0P	3 Credits

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; &

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: SE302-19	Course Title: Computer Networks	3L:1T:0P	3Credits

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. **[8 hrs] (CO5)**

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, SlottedALOHA,CSMA/CDCDMA/CA. **[10 hrs] (CO5)**

Module 3: Network Layer

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols. **[8 hrs] (CO5)**

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] (CO5)**

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] (CO5)**

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.

Suggested 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: SE304-19	**Course Title:** Data Structure & Algorithms Lab	**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: SE305-19	**Course Title: Computer networks** Lab	**0L:0T:2P**	**1Credits**

List of Experiments:

Task1 : To study the different types of Network cables and network topologies

Task2 :Practically implement and test the cross-wired cable and straight through cable using clamping tool and network lab cable tester.

Task3 :Study and familiarization with various network devices.

Task4 :Familiarization with Packet Tracer Simulation tool/any other related tool. Task5 :Study and Implementation of IP Addressing Schemes

Task6 :Creation of Simple Networking topologies using hubs and switches

Task7 :Simulation of web traffic in Packet Tracer

Task8 :Study and implementation of various router configuration commands

Task9 :Creation of Networks using routers.

Task10 :Configuring networks using the concept of subnetting

Task11 :Practical implementation of basic network command and Network configuration commands like ping, ipconfig, netstat , tracert etc. for trouble shooting network related problems.

Task12 :Configuration of networks using static and default routes.

Course Outcomes:

The students will be able to

1: Know about the various networking devices, tools and also understand the implementation of network topologies;

2:Create various networking cables and know how to test these cables;

3:Create and configure networks in packet tracer tool using various network devices and topologies;

4:Understand IP addressing and configure networks using the subnettin;

5:Configure routers using various router configuration commands;&

6:Troubleshoot the networks by using various networking commands.

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:

- 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 HillPublishing 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.

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

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.
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.

Course Code: SE303-18	Course Title: Software Engineering	3L:0T:0P	3Credits

Detailed Contents:

UNIT1:

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. **8 hrs.**

UNIT*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. **6hrs**

UNIT*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. **8 hrs.**

UNIT*4:* Software project management, Project planning and control, cost estimation, project scheduling using PERT and GANTT charts, cost-time relations: Rayleigh-Norden results, quality management **8 hrs.**

UNIT 5: ISO and SEI CMMI, PSP and Six Sigma. Computer aided software engineering, software maintenance, software reuse, Component-based software development. **6 hrs**

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.

Course Code: SE306-18	**Course Title: Software Engineering lab**	**0:0T:P**	**3Credits**

Detailed List of Tasks:

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.

Fourth Semester

Course Code: SE401-19	Course Title: Database management Systems	L:3; T:0; P:0	3Credits

Detailed contents

Module1: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.

Module2: 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.

Module3:Storage strategies
Indices, B-trees, hashing.

Module4:
Transaction processing: Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Controlschemes, Databaserecovery.

Module5:
Database Security: Authentication, Authorization and accesscontrol, DAC, MAC and RBAC models, Intrusion detection, SQLinjection.

Module6:Advanced topics
Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Suggested books:

1. "Database System Concepts", 6th Edition by AbrahamSilberschatz,HenryF. Korth,S.Sudarshan, McGraw-Hill.

Suggested reference books

1 "PrinciplesofDatabaseandKnowledge–BaseSystems",Vol1byJ.D.Ullman, Computer Science Press.
2 "FundamentalsofDatabaseSystems",5thEditionbyR.ElmasriandS.Navathe, PearsonEducation
3 "FoundationsofDatabases", Reprint by Serge Abiteboul, Richard Hull, Victor Vianu,Addison-Wesley

CourseOutcomes

CO1. For a given query write relational algebra expressions for that query and optimize the Developed expressions
CO2. For a given specification of the requirement design the databases using ER method and normalization.

CO3. ForagivenspecificationconstructtheSQLqueriesforOpensourceandCommercial DBMS-MYSQL, ORACLE,andDB2.
CO4. ForagivenqueryoptimizeitsexecutionusingQueryoptimizationalgorithms
CO5. For a given transaction-processing system, determine the transaction atomicity, consistency,isolation, and durability.
CO6. Implement the isolation property, including locking, time stamping based on concurrency control and Serializability of scheduling.

Course Code: SE402-19	Course Title: Computer Organisation and Architecture	3L:1T: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: SE403-19	**Course Title:** Operating Systems	**3L:1T:0P**	**3Credits**

Detailed Contents:

Module1: 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)

Module2: 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, Strict Alternation, 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)

Module5: 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

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Course Code: BTCS404-18	**Course Title:** Design and Analysis of Algorithms	**3L:0T:0P**	**3Credits**

Pre-requisites: Data Structures

Detailed Contents:

Module1: 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, 4^{th} edition, Pearson.
3. Fundamentals of Computer Algorithms – E. Horowitz, Sartaj Saini, Galgota Publications.

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: SE406-19	**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

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Course Code: SE407-19	**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: SE408-19	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.
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: SE405-19	**Course Title: Database management System lab**	**0:0T:4P**	**4Credits**

Details of Tasks:

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

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.

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

Course Code: SE501-19	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)**

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: SE503-19	**Course Title : Agile Software Development Lab**	**L:0T:2P**	**Credits:1**

Detailed List of Tasks:

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

1.

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urse 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)

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: SE502-19	**Course Title:** Software Testing and Quality Assurance	**3L:0T:0P**	**3Credits**	**42 Hours**

Detailed Contents:

Module 1:
Testing as an engineering activity, Role of process in software quality, Testing as a process, Basic definitions, Software testing principles, The tester's role in a software development organization, Origins of defects, Defect classes, The defect repository and test design, Defect examples, Developer / Tester support for developing a defect repository.

[7hrs] (CO 1)

Module 2:

Testing techniques and levels of testing:

Using White Box Approach to Test design - Static Testing Vs. Structural Testing, Code Functional Testing, Coverage and Control Flow Graphs, Using Black Box Approaches to Test Case Design, Random Testing, Requirements based testing, Decision tables, State-based testing, Cause-effect graphing, Error guessing, Compatibility testing, Levels of Testing -Unit Testing, Integration Testing, Defect Bash Elimination. System Testing - Usability and Accessibility Testing, Configuration Testing, Compatibility Testing **[10hrs] (CO2)**

Module 3:

Automation and Quality Metrics

Software Test Automation, Skills needed for Automation, Scope of Automation, Design and Architecture for Automation, Requirements for a Test Tool, Challenges in Automation Tracking the Bug, Debugging. Testing Software System Security - Six-Sigma, TQM - Complexity Metrics and Models, Quality Management Metrics, Availability Metrics, Defect Removal Effectiveness, FMEA, Quality Function Deployment, Taguchi Quality Loss Function, Cost of Quality.

[8 hrs] (CO 3)

Module 4:

Quality Assurance tools and Models

SQA basics, Components of the Software Quality Assurance System, software quality in business context, planning for software quality assurance, product quality and process quality, software process models, 7 QC Tools and Modern Tools.

Models for Quality Assurance, ISO-9000 series, CMM, CMMI, Test Maturity Models, SPICE, Malcolm Baldrige Model- P-CMM **[8hrs] (CO4)**

Module 5:

Quality Assurance trends;

Software Process- PSP and TSP, OO Methodology, Clean-room software engineering, Defect Injection and prevention, Internal Auditing and Assessments, Inspections & Walkthroughs, Case Tools and their Affect on Software Quality.

[6hrs] (CO5)

Text Books:

1. Srinivasan Desikan, Gopalaswamy Ramesh,Software Testing: Principles and Practices Pearson.
2. 2. Daniel Galin, Software Quality Assurance: From Theory to Implementation, Pearson Addison Wesley.

Reference Books:

3. Aditya P. Mathur, Foundations of Software Testing, Pearson.
4. Paul Ammann, Jeff Offutt, Introduction to Software Testing, Cambridge University Press.
5. Paul C. Jorgensen, Software Testing: A Craftsman's Approach, Auerbach Publications.
6. William Perry, Effective Methods of Software Testing, Wiley Publishing, Third Edition.

7. Renu Rajani, Pradeep Oak, Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill.

COURSE Outcomes: By the end of the course, students should be able to

1. Test the software by applying testing techniques to deliver a product free from bugs.

2. Investigate the scenario and to select the proper testing technique.

3. Explore the test automation concepts and tools and estimation of cost, schedule based

on standard metrics.

4. Understand how to detect, classify, prevent and remove defects.

5. Choose appropriate quality assurance models and develop quality.

Course Code: SE504-19	**Course Title:** Software testing& quality assurance Lab	**0L:0T:2P**	**1Credits**

Detailed

Contents:

1.To determine the nature of roots of a quadratic equations, its input is triple of +ve integers (say x,y,z) and values may be from interval[1,100] the program output may have one of the following:- [Not a Quadratic equations, Real roots, Imaginary roots, Equal roots] Perform BVA.

2. To determine the type of triangle. Its input is triple of +ve integers (say x,y,z) and the values may be from interval[1,100].The program output may be one of the following [Scalene, Isosceles, Equilateral, Not a Triangle].Perform BVA

3. Perform robust case testing on Problem No. 1.

4. Perform robust case testing on Problem No. 2.

5. Create a test plan document for any application (e.g. Library Management System)

6. Experiment: Study of Any Testing Tool (Win Runner)

7. Experiment: Study of Any Test Management Tool (QA Complete)

8. Experiment: Automate the Test cases using Test Automation tool(using QA Complete)

9. Experiment: Learn how to raise and report Bugs using Bug tracking tool (Bugzilla,Jira using QA Complete)

10. Experiment: Study of any open source testing tool (Web Performance Analyzer/O STA)

ELECTIVES- I

ourse 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:

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**

Prerequisites: Students should install Python.

List of Experiments:

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:** BTCS521-18	**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
  - 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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ourse Code: BTCS 515-18	Course Title: Computer Graphics	3L:0T:0P	3 Credits	45 Hours

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:

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.
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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ourse 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.

Text Books:

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**

List of Experiments:

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 subject.

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/N/ *Dated :*

NOTIFICATION

Sub: **Regarding Pre-Ph.D Course work.**

This is for information of all concerned that Pre-Ph.D course work from 2016-17 will be conducted in the IKGPTU main campus Kapurthala in regular mode. The PhD course work will consists of minimum 15 credits. The structure of the course work is as under.

Sr. No.	Nature of course	Name of course	Credits	Remarks
1.	Core	1.Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Science, Management/ Humanities and Life sciences
		2.Subject related theory paper	4	Discipline specific related to advancements in theoretical methods for research
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of subjects from allied fields
	Total Minimum credits		**15**	

-Sd-
Registrar

Endorsement No: IKGPTU/REG/N/ 4244-4251 Dated: 22.08.2016

1. Secretary to Vice Chancellor: For kind information of Vice Chancellor
2. Dean (P&D)
3. Dean (RIC)
4. Dean (Academics)
5. Finance Officer
6. Controller of Examination
7. DR (Computers): For uploading on website
8. File Copy

19/8/16
Registrar

I. K. Gujral Punjab Technical University, Jalandhar
Jalandhar Kapurthala Highway, Near Pushpa Gujral Science City, Kapurthala - 144 603
Ph. No. 01822 - 662521. 662501 Fax No. : 01822-255506. 662526. Email : registrar@ptu.ac.in

C.S.E

Pre Ph.D. Course in Computer Science Engineering
Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Cloud Computing 2. Advanced Concepts in Image Processing 3. Advanced Information Security 4. Modelling and Simulation 5. Data Warehousing and Data Mining 6. Mobile Computing Technologies 7. Network Security and Cryptography 8. Advanced Software Engineering 9. Advanced Computer Architecture 10. Advanced Database systems 11. Advanced Data structure & Algorithms 12.Soft Computing 13. Advanced Operating Systems 14. Big Data Analytics
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Advanced Data Communication 2.Internetworking 3.Optimization Techniques 4. Adhoc Wireless and Sensor Networks 5. Neural Networks and Fuzzy Logic 6. Mathematical Foundations of Computer Networks
	Total Minimum credits		15	

Paper Title: Research Presentation

L T P
0 0 3

Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

Pre Ph.D. Course in Computer Science and Engineering
Research Methodology

L T P
4 0 0

1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.
2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them. Method of Research: Descriptive research design-survey, case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.
3. Sampling Techniques : Concept of population and sample' sampling techniques-simple random sampling, stratified random sampling, systematic sampling and cluster sampling, quota sampling techniques determining size of sample. Procedure of data collection: Aspects of data collection, Techniques of data Collection
4. Statistical Methods of Analysis: Descriptive statistics: Meaning, graphical representations, mean, range and standard deviation, characteristics and uses of normal curve. Inferential statistics: t-test. Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way).
5. Procedure for writing a research proposal and report: Purpose, types and components of research proposal, Audiences and types of research reports, Format of Research report and journal.

Case Studies on s/w tools used for research work.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009
2. Richard I. Levin, David S. Rubin, Statistics for Management (7th Edition), Pearson Education India.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006
4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006

Pre Ph.D. Course in Computer Science and Engineering
Cloud Computing

L	T	P
4	0	0

1. Cloud Computing Basics: Cloud Computing Overview; Characteristics; Applications; Internet and Cloud; Benefits; Limitations; Challenges.
2. Cloud Computing Services and Deployment Models: Infrastructure as a Service; Platform as a Service; Software as a Service; Private Cloud; Public Cloud; Community Cloud; Hybrid Cloud.
3. Cloud Computing vs Other Computing Technologies: Overview of Grid, Peer-to-Peer, Pervasive and Utility Computing technologies; their characteristics and comparison between them.
4. Accessing the Cloud: Hardware and Infrastructure requirements; Access Mechanisms: Web Applications, Web APIs, Web Browsers. Cloud Storage and Cloud Standards: Overview; Storage as a Service; Cloud Storage Issues; Challenges; Standards.
5. Security Issues: Securing the Cloud, Securing Data, Establishing identity and presence. Developing Applications: Major Players in Cloud Business; Overview of Service Oriented Architecture; Tools for developing cloud services and applications.
6. Introduction to Google App Engine, Azure Services Platform, Amazon EC2, Amazon S3. Migrating to the Cloud: Overview; Issues; Approaches.

Books

1. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill, 2010.
2. Rajkumar Buyys, James Broberg, Andrzej Goscinski (Editors), Cloud Computing: Principles and Paradigms, Wiley, 2011.
3. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley, 2010.
5. Borko Furht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.
6. Dimitris N. Chorafas, CRC Press, Taylor and Francis Group, 2011.

Pawan Maini

Pre Ph.D. Course in Computer Science and Engineering

Advanced Concepts in Image Processing

L	T	P
4	0	0

1. Introduction to Image Processing: Introduction to Digital Image Processing, Examples and Components of Digital Image Processing, Digital Image fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Linear And Nonlinear Operations, Color Models.

2. Image Enhancements and Restoration: Gray Level Transformations, Histogram Processing, Enhancement Using Spatial Filtering: Smoothing Filters, Sharpening Filters, Image Enhancement in the frequency domain: Introduction to the Fourier Transform , Smoothing filters, Sharpening Filters, Homomorphic Filtering, Image Restoration : Image Degradation/ Restoration Process, Noise Models, Periodic Noise Reduction by Frequency Domain filtering, Linear, Position-Invariant Degradations, Estimating the degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener)Filtering, Constrained Least Squares Filtering, Morphological Image Processing.

3. Image Compression and wavelets: fundamentals, image compression models, elements of information theory, error free compression lossy compression, image compression standards, Color Fundamentals, Wavelets and multiresolution processing: multiresolution expansions, wavelets transforms in one dimension, the fast wavelet transform, wavelets transforms in two dimensions, wavelet packets.

Image Segmentation, Recognition and Analysis: Image Segmentation : Detection of 4. Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region- Based Segmentation, Representation and Description :Boundary descriptors, Regional Descriptors, Use of Principal Components for Description , Relational Descriptors, Object Recognition : Patterns and Pattern Classes, Recognition Based on Decision- Theoretic Methods, Structural Methods. Case studies on research areas related to image processing.

Books:

1. Gonzalez and Woods, "Digital Image Processing" ISDN 0-201-600-781, Addison Wesley 1992.
2. Trucco & Verri, "Introductory techniques for 3-D Computer Vision", Prentice Hall.
3. Jain, A.K. Kasturi and Scunk, "Fundamental of Digital Image Processing", Tata Mc-Graw-Hill 1995.
4. Sonka, Hlavac, Boyle. "Image Processing, Analysis and Machine Vision" 2nd ed. PWS Publishing, 1999.
5. Madhuri A. Joshi,"Digital Image Processing: An Algorithmic Approach ",PHI learning private limited.
6. S. Jayaraman, S.Esakkirajan, T. Veerakumar," Digital Image Processing",Tata McGraw Hill,2010

Pre Ph.D. Course in Computer Science and Engineering
Advanced Information Security

L	T	P
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1. Introduction to Security/Security Models: Introduction to Computer Security, Threats , Security Policy , Formal Model and Mechanism ,Security Trends , Security Attacks, Trust and assurance , Confidentiality and Integrity Model, Lattice Model ,Bell-LaPadulla Model , Access Control Matrix Model ,HRU Model, Integrity Model , Biba Integrity Model , Clark Wilson Model , Originator Controlled Access Control, Role based Access Control,Study of Emerging Access Control Models.

2. Cryptography and Cryptosystem: Cryptography, Classical Cryptosystems, DES , AES, Computational vs. Unconditional (or Information-Theoretic) Security; One-Way Functions and Hash Functions; Design Principles; Examples: MD5, Secure Hash Algorithm (SHA-1), etc.; Hashing with Block Ciphers; MACs from Hash Functions , Public-Key Cryptography , Trapdoor Functions; Fast Exponentiation; Square-and-Multiply Algorithm; Diffie-Hellman Key Agreement Protocol, Status of Security; Rivest-Shamir-Adleman (RSA) System , Elliptic Curve Cryptosystems , Discrete Logarithm Algorithms , Digital Signatures; Digital Signatures Based on Discrete Logarithms, Public-Key Certificates; Key Management Protocol, X.509,PGP,Study of Emerging Cryptography Techniques .

3. Intrusion detection and prevention models for network security: Intrusion Detection, Models, Architecture, NIDS, HIDS, Network Security , Network Security Attacks, Applications of Cryptography in Network Security; Encryption at Different OSI-Layers; Code Based Vulnerabilities, Policy Deployment in Network

4. Study of Emerging Intrusion Detection and Prevention Techniques , Protection in general purpose operating systems , Data base protection and security. Assurance and Trust, Building Secure and Trusted Systems, Software Design Assurance, Formal Methods, Formal Specification and Verification , Formal Specification Languages, Evaluation System Criteria , TCSEC , ITSEC , Common Criteria, Disaster Recovery and Business Continuity, Organisational Policies , Risk Management.

Book

1. Bishop, Matt: Introduction to Computer Security. Addison-Wesley, Pearson Education, Inc.

2. William Stallings," Cryptography and Network Security Principles and Practice", 2/e,Pearson Education.

3. Michael. E. Whitman and Herbert J. Mattord ," Principles of Information Security" .

4. William Stallings,"Network Security Essentials, Applications and Standards",Pearson Education.

5. J Pieprzyk,Thomas and Jennifer,"Fundamental of Computer Security",Springer.

6. Arthur and White,"Principles of Computer Security",Tata Mcgraw Hill.

Pre Ph.D. Computer Science and Engineering
Modelling and Simulation

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1. Introduction: What is modeling and simulation? Application areas, definition and types of system, model and simulation, introduction to discrete-event and continuous simulation.
2. Simulation Methods: Discrete-event Simulation, Time advance Mechanisms, Components and organization of Discrete-event simulation, Flowchart of next-event time advance approach, Continuous Simulation, Random Number generation methods.
3. Queuing Models: Single server queuing system, introduction to arrival and departure time, flowcharts for arrival and departure routine. Event graphs of queuing model. Determining the events and variables.
4. Distribution Functions: Stochastic activities, Discrete probability functions, Cumulative distribution function, Continuous probability functions. Generation of random numbers following binomial distribution, poisson distribution, continuous distribution, normal distribution, exponential distribution, uniform distribution.
5. Programming in MATLAB: Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
6. Programming in GPSS and C/C++: Basic Introduction to Special Simulation Languages: GPSS and Implementation of Queuing Models using C/C++.
7. Introduction to Simulators: Introduction regarding features and usage of any Network simulator.

Books:

1. Averill M.Law and W. david Kelton," Simulation Modeling and Analysis", Tata McGraw-Hill Publication.
2. Geoffery Gordon," System Simulation", Prentice-Hall of India.
3. D.S.Hira," System Simulation", S.Chand Publications
4. Stephen J. Chapman," MATLAB Programming for Engineers", Thomson learning inc.
5. Jerry Banks, John S. Carson, Barry L. Nelson and David M. Nicol,"Discrete-Event System Simulation", Prentice-Hall of India.

Pre Ph.D. Course in Computer Science and Engineering
Data Warehousing and Data Mining

L	T	P
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1. Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues.
2. Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM.
3. Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation.
4. Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons.
5. Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining.
6. Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbour classification, Cluster analysis, Types of data in clustering, categorization of clustering methods.

Books:
1. Data Mining: Concepts and Techniques By J.Han and M. Kamber, Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
2. Data Mining Introductory and Advance Topics By Dunham, Pearson Education, Latest Edition

Pre Ph.D. Course in Computer Science and Engineering
Mobile Computing Technologies

L	T	P
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1. Introduction to Mobile Computing Architecture Mobile Computing – Middleware and Gateways – Application and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled. Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card – GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS – GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications for GPRS – Limitations of GPRS.
2. Wireless Application Protocol (WAP) and Wireless LAN WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN Intelligent Networks and Interworking Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling.
3. Client Programming, Palm OS, Symbian OS, Win CE Architecture Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture J2ME JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues.
4. Voice over Internet Protocol and Convergence Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparison between H.323 and SIP – Real Time protocols – Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP Security Issues in Mobile Computing.

BOOKS: 1. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
2. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education
3. The CDMA 2000 System for Mobile Communications – Vieri Vaughi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

Pre Ph.D. Course in Computer Science and Engineering
Network Security and Cryptography

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1. Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
2. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Conventional Encryption:Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography:Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.
3. Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. Message authentication and Hash functions:Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
4. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service.Electronic Mail Security: Pretty Good Privacy, S/MIME.
5. IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms : Intruders, Viruses and Related threats. Fire Walls : Fire wall Design Principles, Trusted systems.

BOOK:

1. Cryptography and Network Security: Principles and Practice - William Stallings, 2000, PE.
2. Principles of Network and Systems Administration, Mark Burgess,John Wielly.

Raman Maini

Pre Ph.D. Course in Computer Science and Engineering
Advanced Software Engineering

L	T	P
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1. Software Project Management: Software Project Planning and its characteristics, Types of metrics, Effort Estimation- FP, LOC, FP vs. LOC, Schedule & Cost Estimation Models-Activity Networks-PERT/CPM, COCOMO-I, COCOMO-II, Risk Assessment- Probability Matrix, Risk Management. Agile Methodology- Scrum and XP. Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, using Z to represent an example software component, the ten commandments Of formal methods, Formal methods- the road ahead.
2. Component-Based Software Engineering: CBSE process, Domain engineering, Componentbased development, Classifying and retrieving components and economics of CBSE. Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues
3. Web Engineering: Attributes Of web-based applications, the Web E process, a framework for Web E. Formulating, Analysing web-based systems, design and testing for web-based applications, Management issues. Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.
4. Software Quality: CASE tools, metrics, Standards, Certification and Assessment. TQM, Bootstrap methodology, The SPICE project, ISO-IEC 15504, Six Sigma Concept for Software Quality. Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy Of CASE tools, integrated CASE environments, Integration architecture, and CASE repository.

Books

1. Software Engineering a Practitioners Approach, Roger S. Pressman, McGraw-Hill 8th Edition, 2014
2. Formal Specification and Documentation testing - A Case Study Approach, J.Bowan , International Thomson Computer Press, 2003
3. Software Engineering for Embedded Systems: Methods, Practical and Applications, Robert Oshana, Mark Kraeling, Newnes Publisher, 2013
4. Software engineering an engineering approach, James S. Peters, WitoldPedrycz, Wiley India, 2011.
5. Software Engineering Principles and Practice, Hans Van Vliet, Yded (WILEY), 2015.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Computer Architecture

L	T	P
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1. Fundamentals of Processors: Instruction set architecture; single cycle processors, hardwired and micro-coded FSM processors; pipelined processors, multi-core processors; resolving structural, data, control and name hazards; analyzing processor performance.

2. Fundamentals of Memories: memory technology; direct-mapped, associative cache; write-through and write-back caches; single-cycle, FSM, pipe-lined cache; Analyzing memory performance.

3. Advanced Processors: Superscalar execution, out-of-order execution, register renaming, memory disambiguation, dynamic instruction scheduling, branch prediction, speculative execution; multithreaded, VLIW and SIMD processors.

4. Advanced Memories: non-blocking cache memories; memory protection, translation and virtualization; memory synchronization, consistency and coherence.

Books:
1. Computer Architecture: A Quantitative Approach, by J.L Hennessy and D.A Patterson.
2. Digital Design and Computer Architecture, by D.M Harris and S.L Harris.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Database Systems

L	T	P
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1. Data Base Analysis and Design Techniques: Review of basic Database Concepts, Database Design Methodologies. ER Modeling: Specialization, Generalization, Aggregation, Normalization Theory. Database Implementation using UML: Introduction to UML, Structure diagrams, behavioral diagrams, object oriented analysis, class diagram. Advanced Transaction Processing and Concurrency Control: Transaction Concepts, Concurrency Control: Locking Methods, Timestamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems.
2. Query Compiler: Introduction, parsing, generating logical query plan from parse tree. Query Processing: Physical-Query-plan Operators. Operations: selection, sorting, join, project, set. Query Evaluation: Introduction, Approaches to Query Evaluation, Transformation of relational expressions in Query optimization, heuristic optimization, cost estimation for various operations, transformation rule.
3. Distributed Database Centralized DBMS and Distributed DBMS, functions and architecture of a DDBMS, Distributed Data Storage, Transparency issues in DDBMS, Query Processing DDBMS, Distributed transaction Management and Protocols, Distributed Concurrency Control and Deadlock Management. Object Oriented Database: Limitations of RDBMS, Need of Complex Datatype, Data Definition, ODBMS Fundamentals, issues in OODBMS, Object-oriented database design. Comparison of ORDBMS and OODBMS.
4. Emerging Database Models, Technologies and Applications Multimedia database-Emergence, Temporal Databases, difference from other data types, structure, deductive databases, GIS and spatial databases, Knowledge database, Information Visualization, Wireless Networks and databases, Personal database, Digital libraries, web databases, case studies of the emerging databases.

Books:

1. Distributed Databases by Ozsu and Valduriez ,Pearson Education.
2. Fundamentals of Database Systems by RamezElmasri, ShamkantNavathe, Pearson Education
3. Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Tata McGraw-Hill.
4. Advanced database management system by RiniChkrabarti and ShibhadraDasgupta, Dreamtech.
5. An Introduction to Database Systems, C J Date, Addison Wesley Publishing Company.
6. An Introduction to Data Systems, Bipin C. Desai, West Publishing Company.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Data Structures & Algorithms

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1. Algorithms Complexity and Analysis: Recurrence Relations, Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Bin Sort, Multi-way merge sort, Polyphase merging, Search: Linear, Binary, Hashing. Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps,
2. Data Structures for Disjoint Sets, Augmented Data Structures.
3. Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, HamiltonianPaths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Depth- and breadth-first traversals.
4. Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut problem.
5. String Matching Algorithms: Suffix arrays, Suffix trees, Rabin-Karp, Knuth-Morris-Pratt, BoyerMoore.
6. Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.
7. Randomized Algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min-Cut, 2- SAT; Game Theoretic Techniques, Random Walks.

Books:

1. Thomas Coremen, "Introduction to Algorithms", Third edition, Prentice Hall of India (2009).
2. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.
3. Motwani R., Raghavan P., "Randomized Algorithms", Cambridge University Press, 1995.
4. Vazirani, Vijay V., "Approximation Algorithms", Springer, 2001.

Pre Ph.D. Course in Computer Science and Engineering
Soft Computing

L	T	P
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1. Soft Computing: An introduction. Artificial Neural Network: An introduction, Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network and other networks, Associative memory networks, Unsupervised Learning Networks.

2. Fuzzy Logic: Introduction to Fuzzy logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership functions, Defuzzification, Fuzzy Arithmetic and Fuzzy measures, Fuzzy Rule base and approximate reasoning, Fuzzy decision making

3. Genetic Algorithm: An introduction, Traditional Optimization and Search Techniques, GA and Search Space, General GA, Operators in GA, Stopping Condition and GA flow, Constraints in GA, Classification of GA, Genetic Programming.

4. Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems.

Books:

1. Principals of Soft Computing by Sivanandam and S. N. Deepa, Wiley Publication.
2. NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND APPLICATIONS By S. RAJASEKARAN, G. A. VIJAYALAKSHMI, PHI.
3. Introduction to Soft Computing By Samir Roy and Udit Chakraborty, Pearson.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Operating Systems

L	T	P
4	0	0

1. Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm,Basic concepts of Distributed Mutual Exclusion ,Lamport's Algorithm, RicartAgrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system
2. Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing. Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols - Design Issues. Distributed Scheduling, Issues, Components, Algorithms. Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls.
3. Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols
4. Multiprocessor System: Definition, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization. Real Time Operating systems: Fundamentals of real time operating systems, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization. Analytic Modeling: Introductions, Queuing Theory, Markov Process.

Books:

1. OperatingSystemsConcepts &design-MilanMilenkovic,TMH
2. OperatingSystem- H.M. Deitel,Pearsons.
3. AdvancedConcepts inoperatingSystems-MukeshSinghal andNiranjanG.Shivaratri,TMH
4. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw- Hill, 2000
5. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Sixth Addison n Wesley Publishing Co., 2003.

Raman Maini

Pre Ph.D. Course in Computer Science and Engineering
Big Data Analytics

L	T	P
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1. An Overview of Big Data and Big Data Analytics. Understanding Hadoop Ecosystem (Hadoop Distributed File System, MapReduce, Hadoop YARN, HBase, Combining HBase and HDFS, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie). MapReduce Framework, Techniques to Optimize MapReduce Jobs, Role of HBase in Big Data Processing
2. Developing Simple MapReduce Application, Points to Consider while Designing MapReduce. Controlling MapReduce Execution with InputFormat, Reading Data with Custom RecordReader, Organizing Output Data with OutputFormats, Customizing Data with RecordWriter, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners.
3. YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, Commands, Containers. Introduction to NoSQL. Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models.
4. Analytical Approaches, Introducing to various Analytical Tools, Installing R, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and Using Objects, Interacting with Users, Handling Data in R Workspace, Executing Scripts, Reading Datasets and Exporting Data from R, Manipulating and Processing Data in R, Working with Functions and Packages in R, Performing Graphical Analysis in R, Techniques Used for Visual Data Representation, Types of Data Visualization

Books:

1. Big Data, Black Book by DT Editorial Services, Dreamtech Press.
2. Big Data Computing and Communications edited by Yu Wang, Hui Xiong, Shlomo Argamon, XiangYang Li, JianZhong Li, Springer
3. Big Data Analytics Beyond Hadoop by Vijay Srinivas Agneeswaran, FT Press.

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Advanced Data Communication

L	T	P
4	0	0

1. Digital Modulation: Introduction, Information Capacity Bits, Bit Rate, Baud, and M-ARY Coding, ASK, FSK, PSK, QAM, BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

2.Basic Concepts of Data Communications, Interfaces and Modems: Data Communication Components, Networks, Distributed Processing, Network Criteria- Applications, Protocols and Standards, Standards Organizations- Regulatory Agencies, Line Configuration- Point-to-point Multipoint, Topology- Mesh- Star- Tree- Bus- Ring- Hybrid Topologies, Transmission Modes Simplex- Half duplex- Full Duplex, Categories of Networks- LAN, MAN, WAN and Internetworking, Digital Data Transmission- Parallel and Serial, DTE- DCE Interface- Data Terminal Equipment, Data Circuit- Terminating Equipment, Standards EIA 232 Interface, Other Interface Standards, Modems- Transmission Rates.

3. Error Detection and Correction: Types of Errors- Single- Bit Error, CRC (Cyclic Redundancy Check)- Performance, Checksum, Error Correction- Single-Bit Error Correction, Hamming Code. Data link Control: Stop and Wait, Sliding Window Protocols. Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocol- Binary Synchronous Communication (BSC) - BSC Frames- Data Transparency, Bit Oriented Protocols – HDLC, Link Access Protocols.

4. Switching: Circuit Switching- Space Division Switches- Time Division Switches- TDM Bus Space and Time Division Switching Combinations- Public Switched Telephone Network, Packet Switching, Circuit Switched Versus Virtual Circuit Connection, Message Switching.

5. Multiplexing: Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing, Digital Hierarchy, Statistical Time Division Multiplexing. Multiple Access: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Detection (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization- Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), - Code - Division Multiple Access (CDMA).

BOOKS:

1. Data Communication and Computer Networking - B. A.Forouzan, 3rded., 2008, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8th ed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2nd Edition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2nd ed., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John Wiley & Sons, 2004.

Raman Maini

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Internetworking

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1. Internetworking concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite. IP Address: Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting IP Address: Classless Addressing: - Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router. ARP and RARP:ARP, ARP Package, RARP.
2. Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6. Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times. Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control. Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.
3. Unicast Routing Protocols (RIP, OSPF, and BGP): Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP. Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.
4. Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet. Remote Login TELNET:- Concept, Network Virtual Terminal (NVT). File Transfer FTP and TFTP: File Transfer Protocol (FTP). Electronic Mail: SMTP and POP. Network Management-SNMP: Concept, Management Components. World Wide Web- HTTP Architecture. Multimedia: Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

BOOKS:

1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH.
2. Internetworking with TCP/IP Comer 3rd edition PHI.
3. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
4. Data Communications & Networking – B.A. Forouzan – 2nd Edition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Optimization Techniques

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1. Introduction to Optimization Techniques, Origin & development of O.R., Nature & Characteristic, features of O.R., Models & Modeling in Operation Research. Methodology of O.R.
2. Linear Programming - Mathematical Model, Assumptions of Linear Programming, Graphical Method, Principles of Simplex method and its Applications, Two Phase & Big M-method, Revised simplex method , Duality, Dual simplex method- Primal Dual Relationship and sensitivity analysis.
3. Linear Programming: Mathematical formation of linear programming problem, Special types of linear programming problems -Transportation and assignment problems, Unbalanced Assignment problems, Crew based assignment problems, Test for Optimality, Degeneracy in Transportation Problems, Unbalanced Transportation Problems.
4. Definition of Probability, Sample Space, Algebra of Events, Addition and multiplication law of probability, Conditional Probability. Dynamic Programming-Features and applications of dynamic programming.
5. Decision Theory, Integer Programming, Gomory Method and Branch & Bound Method.

Books:

1. Kapoor, V.K.: Operation Research, Sultan Chand & Co., New Delhi.
2. Man Mohan, Gupta P.K.: Operation Research, Sultan Chand & Co., New Delhi.
3. Pronsen, Richard: Theory and Problems of Operation Research, McGraw Hill, 1983.
4. Hiller, F.S. & Liberman, G.J., 1974: Introduction to Operations Research, 2nd Edn. Holden
5. Rao, S. S., 1978: Introduction to Optimization: Theory & Applications, Wiley Eastern.
6. Srinath, L.S.: Linear Programming, East-West, New Delhi.

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Adhoc Wireless and Sensor Networks

L	T	P
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1. AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms.
2. ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols. Transport layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.
3. QUALITY OF SERVICE: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. ENERGY MANAGEMENT: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes.
4. WIRELESS SENSOR NETWORKS: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

BOOKS: 1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.
2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control Jagannathan Sarangapani, CRC Press.
3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.
4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Neural Networks and Fuzzy Logic

L	T	P
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1. Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization.
2. Supervised Learning: Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feedforward Network, Radial- Basis Function (RBF) network & its learning strategies.
3. Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's, Self-organizing Maps.
Neurodynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-aBox network, Bidirectional associative memories.
4. Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic.

Books:

1. Satish Kumar,"Neural Network : A classroom approach", Tata McGraw Hill.
2. Jacek M.Zurada," Artificial Neural Networks", West Publication.
3. Rajasekaran & Pai,"Neural networks, Fuzzy logic and genetic algorithms", PHI learning Pvt. Ltd.

Raman Mann

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Mathematical Foundations of Computer Networks

L	T	P
4	0	0

1. Basic algorithms on directed graphs, weighted shortest paths.

2. Networks and routing algebras - fixed-point equations, sequential algorithm to solve the fixed-point equations, generalized distance-vector and link-state routing protocols.

3. Applications to quality-of service intra-domain routing and to policy-based inter-domain routing in the Internet.

4. Network flows - flows and residual networks, Max-flow Min-cut theorem, Ford Fulkerson method and Edmonds-Karp algorithm.

5. Network calculus- Min-plus calculus: integrals and convolutions, Arrival curves and token buckets; service curves and schedulers, Applications to integrated and differentiated services in the Internet.

Books:
1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. Introduction to algorithms, 2th edition. The MIT Press 2001 [Chapter VI]
2. Jorgen Bang-Jensen and Gregory Gutin. Digraphs: theory, algorithms and applications. Springer, 2002 [Section 7.3 and 9.5]
3. J. L. Sobrinho, An algebraic theory of dynamic network routing, IEEE/ACM Transactions on Networking, 13(5), October 2005.
4. Jean-Yves Le Boudec and Patrick Thiran. Network calculus. Springer, 2006. [Chapter 1, 2, and 3]

I.K. GUJRAL PUNJAB TECHNICAL UNIVERSITY

Estd. Under Punjab Technical University Act, 1996
(Punjab Act No. 1 of 1997)

Ref. No. : IKGPTU/Reg/N/ **Dated :**

NOTIFICATION

Sub: **Regarding Pre-Ph.D Course work.**

This is for information of all concerned that Pre-Ph.D course work from 2016-17 will be conducted in the IKGPTU main campus Kapurthala in regular mode. The PhD course work will consists of minimum 15 credits. The structure of the course work is as under.

Sr. No.	Nature of course	Name of course	Credits	Remarks
1.	Core	1.Research Methodology	4	The syllabus of RM should be formulated faculty wise such as Engineering, Science, Management/ Humanities and Life sciences
		2.Subject related theory paper	4	Discipline specific related to advancements in theoretical methods for research
		3. Presentation	3	Discipline specific
2.	Interdisciplinary	4. Elective	4	From list of subjects from allied fields
	Total Minimum credits		**15**	

-Sd-
Registrar

Endorsement No: IKGPTU/REG/N/ 4244-4251 Dated: 22.08.2016

1. Secretary to Vice Chancellor: For kind information of Vice Chancellor
2. Dean (P&D)
3. Dean (RIC)
4. Dean (Academics)
5. Finance Officer
6. Controller of Examination
7. DR (Computers): For uploading on website
8. File Copy

19/8/16
Registrar

C.S.E

Pre Ph.D. Course in Computer Science Engineering
Schematic and Syllabus

Sr. no.	Nature of Course	Name of course	Credits	Remarks
1.	Core	Research Methodology	4	The syllabus of RM should be formulated faculty wise
		Discipline Specific subjects	4	1.Cloud Computing 2. Advanced Concepts in Image Processing 3. Advanced Information Security 4. Modelling and Simulation 5. Data Warehousing and Data Mining 6. Mobile Computing Technologies 7. Network Security and Cryptography 8. Advanced Software Engineering 9. Advanced Computer Architecture 10. Advanced Database systems 11. Advanced Data structure & Algorithms 12.Soft Computing 13. Advanced Operating Systems 14. Big Data Analytics
		Presentation	3	Discipline specific
2.	Interdisciplinary	Elective	4	From list of subjects from allied fields 1.Advanced Data Communication 2.Internetworking 3.Optimization Techniques 4. Adhoc Wireless and Sensor Networks 5. Neural Networks and Fuzzy Logic 6. Mathematical Foundations of Computer Networks
	Total Minimum credits		**15**	

Paper Title: Research Presentation

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Research Scholar will have to present a seminar based upon his/her research area. Performance of the scholar and participation in seminar will be taken into consideration.

Pre Ph.D. Course in Computer Science and Engineering
Research Methodology

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1. Introduction Research Methodology: Definition of Research, Need of Research, Concept and steps of Research Methodology , Uses of Research Methodology, Research Techniques. Reviewing Literature: Need, Sources-Primary and Secondary, Purposes of Review, Scope of Review, Steps in conducting review.
2. Identifying and defining research problem: Locating. Analyzing stating and evaluating problem, Generating different types of hypotheses and evaluating them. Method of Research: Descriptive research design-survey. case study, content analysis, Ex-post Facto Research, Correlational and Experimental Research.
3. Sampling Techniques : Concept of population and sample' sampling techniques-simple random sampling. stratified random sampling. systematic sampling and cluster sampling. quota sampling techniques determining size of sample. Procedure of data collection: Aspects of data collection, Techniques of data Collection
4. Statistical Methods of Analysis: Descriptive statistics: Meaning, graphical representations. mean, range and standard deviation, characteristics and uses of normal curve. Inferential statistics: t-test. Chi-square tests. Correlation (rank difference and product moment), ANOVA (one way).
5. Procedure for writing a research proposal and report: Purpose, types and components of research proposal, Audiences and types of research reports, Format of Research report and journal.

Case Studies on s/w tools used for research work.

Books:

1. C.R. Kothari, "Research Methodology – Methods and Techniques", Wiley Eastern Ltd 2009
2. Richard I. Levin, David S. Rubin, Statistics for Management (7th Edition), Pearson Education India.
3. K. N. Krishnaswamy, Appa Iyer Sivakumar, M. Mathirajan," Management Research Methodology: Integration of Methods and Techniques, Pearson, 2006
4. S.P Gupta,"Statistical Methods", Sultan Chand & Sons, 2006

Pre Ph.D. Course in Computer Science and Engineering
Cloud Computing

L	T	P
4	0	0

1. Cloud Computing Basics: Cloud Computing Overview; Characteristics; Applications; Internet and Cloud; Benefits; Limitations; Challenges.
2. Cloud Computing Services and Deployment Models: Infrastructure as a Service; Platform as a Service; Software as a Service; Private Cloud; Public Cloud; Community Cloud; Hybrid Cloud.
3. Cloud Computing vs Other Computing Technologies: Overview of Grid, Peer-to-Peer, Pervasive and Utility Computing technologies; their characteristics and comparison between them.
4. Accessing the Cloud: Hardware and Infrastructure requirements; Access Mechanisms: Web Applications, Web APIs, Web Browsers. Cloud Storage and Cloud Standards: Overview; Storage as a Service; Cloud Storage Issues; Challenges; Standards.
5. Security Issues: Securing the Cloud, Securing Data, Establishing identity and presence. Developing Applications: Major Players in Cloud Business; Overview of Service Oriented Architecture; Tools for developing cloud services and applications.
6. Introduction to Google App Engine, Azure Services Platform, Amazon EC2, Amazon S3. Migrating to the Cloud: Overview; Issues; Approaches.

Books

1. Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter, Cloud Computing: A Practical Approach, McGraw Hill, 2010.
2. Rajkumar Buyys, James Broberg, Andrzej Goscinski (Editors), Cloud Computing: Principles and Paradigms, Wiley, 2011.
3. Barrie Sosinsky, Cloud Computing Bible, Wiley, 2011.
4. Judith Hurwitz, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley, 2010.
5. Borko Furht, Armando Escalante (Editors), Handbook of Cloud Computing, Springer, 2010.
6. Dimitris N. Chorafas, CRC Press, Taylor and Francis Group, 2011.

Pre Ph.D. Course in Computer Science and Engineering

Advanced Concepts in Image Processing

L	T	P
4	0	0

1. Introduction to Image Processing: Introduction to Digital Image Processing, Examples and Components of Digital Image Processing, Digital Image fundamentals: Elements of Visual Perception, Light and the Electromagnetic Spectrum, Image Sensing and Acquisition, Image Sampling and Quantization, Basic Relationships Between Pixels, Linear And Nonlinear Operations, Color Models.
2. Image Enhancements and Restoration: Gray Level Transformations, Histogram Processing, Enhancement Using Spatial Filtering: Smoothing Filters, Sharpening Filters, Image Enhancement in the frequency domain: Introduction to the Fourier Transform , Smoothing filters, Sharpening Filters, Homomorphic Filtering, Image Restoration : Image Degradation/ Restoration Process, Noise Models, Periodic Noise Reduction by Frequency Domain filtering, Linear, Position-Invariant Degradations, Estimating the degradation Function, Inverse Filtering, Minimum Mean Square Error(Wiener)Filtering, Constrained Least Squares Filtering, Morphological Image Processing.
3. Image Compression and wavelets: fundamentals, image compression models, elements of information theory, error free compression lossy compression, image compression standards, Color Fundamentals, Wavelets and multiresolution processing: multiresolution expansions, wavelets transforms in one dimension, the fast wavelet transform, wavelets transforms in two dimensions, wavelet packets.
Image Segmentation, Recognition and Analysis: Image Segmentation : Detection of 4. Discontinuities, Edge Linking and Boundary Detection, Thresholding, Region- Based Segmentation, Representation and Description :Boundary descriptors, Regional Descriptors, Use of Principal Components for Description , Relational Descriptors, Object Recognition : Patterns and Pattern Classes, Recognition Based on Decision- Theoretic Methods, Structural Methods. Case studies on research areas related to image processing.

Books:

1. Gonzalez and Woods, "Digital Image Processing" ISDN 0-201-600-781, Addison Wesley 1992.
2. Trucco & Verri, "Introductory techniques for 3-D Computer Vision", Prentice Hall.
3. Jain, A.K. Kasturi and Scunk, "Fundamental of Digital Image Processing", Tata Mc-Graw-Hill 1995.
4. Sonka, Hlavac, Boyle. "Image Processing, Analysis and Machine Vision" 2nd ed. PWS Publishing, 1999.
5. Madhuri A. Joshi,"Digital Image Processing: An Algorithmic Approach ",PHI learning private limited.
6. S. Jayaraman, S.Esakkirajan, T. Veerakumar," Digital Image Processing",Tata McGraw Hill,2010

Pre Ph.D. Course in Computer Science and Engineering
Advanced Information Security

L	T	P
4	0	0

1. Introduction to Security/Security Models: Introduction to Computer Security, Threats , Security Policy , Formal Model and Mechanism ,Security Trends , Security Attacks, Trust and assurance , Confidentiality and Integrity Model, Lattice Model ,Bell-LaPadulla Model , Access Control Matrix Model ,HRU Model, Integrity Model , Biba Integrity Model , Clark Wilson Model , Originator Controlled Access Control, Role based Access Control,Study of Emerging Access Control Models.
2. Cryptography and Cryptosystem: Cryptography, Classical Cryptosystems, DES , AES, Computational vs. Unconditional (or Information-Theoretic) Security; One-Way Functions and Hash Functions; Design Principles; Examples: MD5, Secure Hash Algorithm (SHA-1), etc.; Hashing with Block Ciphers; MACs from Hash Functions , Public-Key Cryptography , Trapdoor Functions; Fast Exponentiation; Square-and-Multiply Algorithm; Diffie-Hellman Key Agreement Protocol, Status of Security; Rivest-Shamir-Adleman (RSA) System , Elliptic Curve Cryptosystems , Discrete Logarithm Algorithms , Digital Signatures; Digital Signatures Based on Discrete Logarithms, Public-Key Certificates; Key Management Protocol, X.509,PGP,Study of Emerging Cryptography Techniques .
3. Intrusion detection and prevention models for network security: Intrusion Detection, Models, Architecture, NIDS, HIDS, Network Security , Network Security Attacks, Applications of Cryptography in Network Security; Encryption at Different OSI-Layers; Code Based Vulnerabilities, Policy Deployment in Network
4. Study of Emerging Intrusion Detection and Prevention Techniques , Protection in general purpose operating systems , Data base protection and security. Assurance and Trust, Building Secure and Trusted Systems, Software Design Assurance, Formal Methods, Formal Specification and Verification , Formal Specification Languages, Evaluation System Criteria , TCSEC , ITSEC , Common Criteria, Disaster Recovery and Business Continuity, Organisational Policies , Risk Management.

Book

1. Bishop, Matt: Introduction to Computer Security. Addison-Wesley, Pearson Education, Inc.
2. William Stallings," Cryptography and Network Security Principles and Practice", 2/e,Pearson Education.
3. Michael. E. Whitman and Herbert J. Mattord ," Principles of Information Security" .
4. William Stallings,"Network Security Essentials, Applications and Standards",Pearson Education.
5. J Pieprzyk,Thomas and Jennifer,"Fundamental of Computer Security",Springer.
6. Arthur and White,"Principles of Computer Security",Tata Mcgraw Hill.

Pre Ph.D. Computer Science and Engineering
Modelling and Simulation

L	T	P
4	0	0

1. Introduction: What is modeling and simulation? Application areas, definition and types of system, model and simulation, introduction to discrete-event and continuous simulation.
2. Simulation Methods: Discrete-event Simulation, Time advance Mechanisms, Components and organization of Discrete-event simulation, Flowchart of next-event time advance approach, Continuous Simulation, Random Number generation methods.
3. Queuing Models: Single server queuing system, introduction to arrival and departure time, flowcharts for arrival and departure routine. Event graphs of queuing model. Determining the events and variables.
4. Distribution Functions: Stochastic activities, Discrete probability functions, Cumulative distribution function, Continuous probability functions. Generation of random numbers following binomial distribution, poisson distribution, continuous distribution, normal distribution, exponential distribution, uniform distribution.
5. Programming in MATLAB: Introduction, Branching statements, loops, functions, additional data types, plots, arrays, inputs/outputs etc.
6. Programming in GPSS and C/C++: Basic Introduction to Special Simulation Languages: GPSS and Implementation of Queuing Models using C/C++.
7. Introduction to Simulators: Introduction regarding features and usage of any Network simulator.

Books:

1. Averill M.Law and W. david Kelton," Simulation Modeling and Analysis", Tata McGraw-Hill Publication.
2. Geoffery Gordon," System Simulation", Prentice-Hall of India.
3. D.S.Hira," System Simulation", S.Chand Publications
4. Stephen J. Chapman," MATLAB Programming for Engineers", Thomson learning inc.
5. Jerry Banks, John S. Carson, Barry L. Nelson and David M. Nicol,"Discrete-Event System Simulation", Prentice-Hall of India.

Pre Ph.D. Course in Computer Science and Engineering
Data Warehousing and Data Mining

L	T	P
4	0	0

1. Introduction: Introduction to RDBMS, Data Warehouse, Transactional Databases, Data Mining Functionalities, Interestingness of pattern, classification of data mining system, major issues.
2. Data Warehouse and OLAP: Difference from traditional databases, Multidimensional data model, Schema for Multi dimensional model, measures, concept hierarchies, OLAP operations, starnet query model, Data Warehouse architecture, ROLAP, MOLAP, HOLAP, Data Warehouse Implementation, Data Cube, Metadata Repositories, OLAM.
3. Data Processing: Data Cleaning, Data Integration and Transformation, Data Reduction, Discretization and concept hierarchy generation.
4. Data Mining Architecture: Data Mining primitives, Task relevant data, interestingness measures, presentation and visualization of patterns, Data Mining Architecture, Concept Description, Data Generalization and Summarization, Attributed oriented induction, Analytical characterization, Mining class comparisons.
5. Association Rules: Association rules mining, Mining Association rules from single level, multilevel transaction databases, multi dimensional relational databases and data warehouses, Correlational analysis, Constraint based association mining.
6. Classification and Clustering: Classification and prediction, Decision tree induction, Bayesian classification, k-nearest neighbour classification, Cluster analysis, Types of data in clustering, categorization of clustering methods.

Books:

1. Data Mining: Concepts and Techniques By J.Han and M. Kamber, Morgan Kaufman publishers, Harcourt India pvt. Ltd. Latest Edition
2. Data Mining Introductory and Advance Topics By Dunham, Pearson Education, Latest Edition

Pre Ph.D. Course in Computer Science and Engineering
Mobile Computing Technologies

L	T	P
4	0	0

1. Introduction to Mobile Computing Architecture Mobile Computing – Middleware and Gateways – Application and Services – Developing Mobile Computing Applications – Security in Mobile Computing – Architecture for Mobile Computing – Three Tier Architecture – Design considerations for Mobile Computing – Mobile Computing through Internet – Making existing Applications Mobile Enabled. Cellular Technologies: GSM, GPS, GPRS, CDMA and 3G Bluetooth – Radio Frequency Identification – Wireless Broadband – Mobile IP – Internet Protocol Version 6 (IPv6) – Java Card – GSM Architecture – GSM Entities – Call Routing in GSM – PLMN Interfaces – GSM addresses and Identifiers – Network aspects in GSM – Authentication and Security – Mobile computing over SMS – GPRS and Packet Data Network – GPRS Network Architecture – GPRS Network Operations – Data Services in GPRS – Applications for GPRS – Limitations of GPRS.
2. Wireless Application Protocol (WAP) and Wireless LAN WAP – MMS – Wireless LAN Advantages – IEEE 802.11 Standards – Wireless LAN Architecture – Mobility in wireless LAN Intelligent Networks and Interworking Introduction – Fundamentals of Call processing – Intelligence in the Networks – SS#7 Signaling.
3. Client Programming, Palm OS, Symbian OS, Win CE Architecture Introduction – Moving beyond the Desktop – A Peek under the Hood: Hardware Overview – Mobile phones – PDA – Design Constraints in Applications for Handheld Devices – Palm OS architecture – Application Development – Multimedia – Symbian OS Architecture – Applications for Symbian, Different flavors of Windows CE -Windows CE Architecture J2ME JAVA in the Handset – The Three-prong approach to JAVA Everywhere – JAVA 2 Micro Edition (J2ME) technology – Programming for CLDC – GUI in MIDP – UI Design Issues.
4. Voice over Internet Protocol and Convergence Voice over IP- H.323 Framework for Voice over IP – Session Initiation Protocol – Comparison between H.323 and SIP – Real Time protocols – Convergence Technologies – Call Routing – Voice over IP Applications – IP multimedia subsystem (IMS) – Mobile VoIP Security Issues in Mobile Computing.

BOOKS: 1. Mobile Computing – Technology, Applications and Service Creation – Asoke K Talukder, Roopa R Yavagal, 2009, TATA McGraw Hill
2. Mobile Communications – Jochen Schiller – 2nd Edition – Pearson Education
3. The CDMA 2000 System for Mobile Communications – Vieri Vaughi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

Pre Ph.D. Course in Computer Science and Engineering
Network Security and Cryptography

L	T	P
4	0	0

1. Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.
2. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers. Conventional Encryption:Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography:Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.
3. Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms. Message authentication and Hash functions:Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.
4. Hash and Mac Algorithms: MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service.Electronic Mail Security: Pretty Good Privacy, S/MIME.
5. IP Security: Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms : Intruders, Viruses and Related threats. Fire Walls : Fire wall Design Principles, Trusted systems.

BOOK:

1. Cryptography and Network Security: Principles and Practice - William Stallings, 2000, PE.
2. Principles of Network and Systems Administration, Mark Burgess,John Wielly.

Raman Saini

Pre Ph.D. Course in Computer Science and Engineering
Advanced Software Engineering

L	T	P
4	0	0

1. Software Project Management: Software Project Planning and its characteristics, Types of metrics, Effort Estimation- FP, LOC, FP vs. LOC, Schedule & Cost Estimation Models- Activity Networks-PERT/CPM, COCOMO-I, COCOMO-II, Risk Assessment- Probability Matrix, Risk Management. Agile Methodology- Scrum and XP. Formal Methods: Basic concepts, mathematical preliminaries, Applying mathematical notions for formal specification, Formal specification languages, using Z to represent an example software component, the ten commandments Of formal methods, Formal methods- the road ahead.
2. Component-Based Software Engineering: CBSE process, Domain engineering, Componentbased development, Classifying and retrieving components and economics of CBSE. Client/Server Software Engineering: Structure of client/server systems, Software engineering for Client/Server systems, Analysis modeling issues, Design for Client/Server systems, Testing issues
3. Web Engineering: Attributes Of web-based applications, the Web E process, a framework for Web E. Formulating, Analysing web-based systems, design and testing for web-based applications, Management issues. Reengineering: Business process reengineering, Software reengineering, Reverse reengineering, Restructuring, Forward reengineering, economics of reengineering.
4. Software Quality: CASE tools, metrics, Standards, Certification and Assessment. TQM, Bootstrap methodology, The SPICE project, ISO-IEC 15504, Six Sigma Concept for Software Quality. Computer-Aided Software Engineering: Building Blocks for CASE, taxonomy Of CASE tools, integrated CASE environments, Integration architecture, and CASE repository.

Books

1. Software Engineering a Practitioners Approach, Roger S. Pressman, McGraw-Hill 8th Edition, 2014
2. Formal Specification and Documentation testing - A Case Study Approach, J.Bowan , International Thomson Computer Press, 2003
3. Software Engineering for Embedded Systems: Methods, Practical and Applications, Robert Oshana, Mark Kraeling, Newnes Publisher, 2013
4. Software engineering an engineering approach, James S. Peters, WitoldPedrycz, Wiley India, 2011.
5. Software Engineering Principles and Practice, Hans Van Vliet, Yded (WILEY), 2015.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Computer Architecture

L	T	P
4	0	0

1. Fundamentals of Processors: Instruction set architecture; single cycle processors, hardwired and micro-coded FSM processors; pipelined processors, multi-core processors; resolving structural, data, control and name hazards; analyzing processor performance.

2. Fundamentals of Memories: memory technology; direct-mapped, associative cache; write-through and write-back caches; single-cycle, FSM, pipe-lined cache; Analyzing memory performance.

3. Advanced Processors: Superscalar execution, out-of-order execution, register renaming, memory disambiguation, dynamic instruction scheduling, branch prediction, speculative execution; multithreaded, VLIW and SIMD processors.

4. Advanced Memories: non-blocking cache memories; memory protection, translation and virtualization; memory synchronization, consistency and coherence.

Books:
1. Computer Architecture: A Quantitative Approach, by J.L Hennessy and D.A Patterson.
2. Digital Design and Computer Architecture, by D.M Harris and S.L Harris.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Database Systems

L	T	P
4	0	0

1. Data Base Analysis and Design Techniques: Review of basic Database Concepts, Database Design Methodologies. ER Modeling: Specialization, Generalization, Aggregation, Normalization Theory. Database Implementation using UML: Introduction to UML, Structure diagrams, behavioral diagrams, object oriented analysis, class diagram. Advanced Transaction Processing and Concurrency Control: Transaction Concepts, Concurrency Control: Locking Methods, Timestamping Methods, Optimistic Methods for Concurrency Control, Concurrency Control in Distributed Systems.
2. Query Compiler: Introduction, parsing, generating logical query plan from parse tree. Query Processing: Physical-Query-plan Operators. Operations: selection, sorting, join, project, set. Query Evaluation: Introduction, Approaches to Query Evaluation, Transformation of relational expressions in Query optimization, heuristic optimization, cost estimation for various operations, transformation rule.
3. Distributed Database Centralized DBMS and Distributed DBMS, functions and architecture of a DDBMS, Distributed Data Storage, Transparency issues in DDBMS, Query Processing DDBMS, Distributed transaction Management and Protocols, Distributed Concurrency Control and Deadlock Management. Object Oriented Database: Limitations of RDBMS, Need of Complex Datatype, Data Definition, ODBMS Fundamentals, issues in OODBMS, Object-oriented database design. Comparison of ORDBMS and OODBMS.
4. Emerging Database Models, Technologies and Applications Multimedia database-Emergence, Temporal Databases, difference from other data types, structure, deductive databases, GIS and spatial databases, Knowledge database, Information Visualization, Wireless Networks and databases, Personal database, Digital libraries, web databases, case studies of the emerging databases.

Books:

1. Distributed Databases by Ozsu and Valduriez ,Pearson Education.
2. Fundamentals of Database Systems by RamezElmasri, ShamkantNavathe, Pearson Education
3. Database System Concepts by Abraham Silberschatz, Henry F. Korth, S. Sudarshan, Tata McGraw-Hill.
4. Advanced database management system by RiniChkrabarti and ShibhadraDasgupta, Dreamtech.
5. An Introduction to Database Systems, C J Date, Addison Wesley Publishing Company.
6. An Introduction to Data Systems, Bipin C. Desai, West Publishing Company.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Data Structures & Algorithms

L	T	P
4	0	0

1. Algorithms Complexity and Analysis: Recurrence Relations, Probabilistic Analysis, Amortized Analysis, Competitive Analysis, Internal and External Sorting algorithms: Quick Sort, Heap Sort, Merge Sort, Counting Sort, Bin Sort, Multi-way merge sort, Polyphase merging, Search: Linear, Binary, Hashing. Advanced Data Structures: AVL Trees, Red-Black Trees, Splay Trees, B-trees, Fibonacci heaps,
2. Data Structures for Disjoint Sets, Augmented Data Structures.
3. Graphs & Algorithms: Representation, Type of Graphs, Paths and Circuits: Euler Graphs, HamiltonianPaths & Circuits; Cut-sets, Connectivity and Separability, Planar Graphs, Isomorphism, Graph Coloring, Covering and Partitioning, Depth- and breadth-first traversals.
4. Minimum Spanning Tree: Prim's and Kruskal's algorithms, Shortest-path Algorithms: Dijkstra's and Floyd's algorithm, Topological sort, Max flow: Ford-Fulkerson algorithm, max flow – min cut problem.
5. String Matching Algorithms: Suffix arrays, Suffix trees, Rabin-Karp, Knuth-Morris-Pratt, BoyerMoore.
6. Approximation algorithms: Need of approximation algorithms: Introduction to P, NP, NP-Hard and NP-Complete; Deterministic, non-Deterministic Polynomial time algorithms; Knapsack, TSP, Set Cover, Open Problems.
7. Randomized Algorithms: Introduction, Type of Randomized Algorithms, Quick Sort, Min-Cut, 2- SAT; Game Theoretic Techniques, Random Walks.

Books:

1. Thomas Coremen, "Introduction to Algorithms", Third edition, Prentice Hall of India (2009).
2. Kleinberg J., Tardos E., "Algorithm Design", 1st Edition, Pearson, 2012.
3. Motwani R., Raghavan P., "Randomized Algorithms", Cambridge University Press, 1995.
4. Vazirani, Vijay V., "Approximation Algorithms", Springer, 2001.

Pre Ph.D. Course in Computer Science and Engineering
Soft Computing

L	T	P
4	0	0

1. Soft Computing: An introduction. Artificial Neural Network: An introduction, Supervised Learning Network: Perceptron Networks, Adaptive Linear Neuron, Multiple Adaptive Linear Neuron, Back Propagation Network and other networks, Associative memory networks, Unsupervised Learning Networks.

2. Fuzzy Logic: Introduction to Fuzzy logic, Classical Sets and Fuzzy Sets, Classical Relations and Fuzzy Relations, Membership functions, Defuzzification, Fuzzy Arithmetic and Fuzzy measures, Fuzzy Rule base and approximate reasoning, Fuzzy decision making

3. Genetic Algorithm: An introduction, Traditional Optimization and Search Techniques, GA and Search Space, General GA, Operators in GA, Stopping Condition and GA flow, Constraints in GA, Classification of GA, Genetic Programming.

4. Hybrid Soft Computing Techniques: An Introduction, Neuro-Fuzzy Hybrid Systems, Genetic Neuro-Hybrid systems, Genetic fuzzy Hybrid and fuzzy genetic hybrid systems.

Books:

1. Principals of Soft Computing by Sivanandam and S. N. Deepa, Wiley Publication.
2. NEURAL NETWORKS, FUZZY LOGIC AND GENETIC ALGORITHM: SYNTHESIS AND APPLICATIONS By S. RAJASEKARAN, G. A. VIJAYALAKSHMI, PHI.
3. Introduction to Soft Computing By Samir Roy and Udit Chakraborty, Pearson.

Pre Ph.D. Course in Computer Science and Engineering
Advanced Operating Systems

L	T	P
4	0	0

1. Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lampert's global state recording algorithm,Basic concepts of Distributed Mutual Exclusion ,Lamport's Algorithm, RicartAgrawala Algorithm; Basic concepts of Distributed deadlock detection, Distributed File system, Architecture, Design issues, SUN Network File system
2. Basic concepts of Distributed shared memory, Basic concepts of Distributed Scheduling, Load balancing, Load sharing. Distributed Resource Management: Distributed File systems, Architecture, Mechanisms, Design Issues, Distributed Shared Memory, Architecture, Algorithm, Protocols - Design Issues. Distributed Scheduling, Issues, Components, Algorithms. Distributed OS Implementation: Models, Naming, Process migration, Remote Procedure Calls.
3. Failure Recovery and Fault Tolerance: Basic Concepts-Classification of Failures, Basic Approaches to Recovery; Recovery in Concurrent System; Synchronous and Asynchronous Checkpointing and Recovery; Check pointing in Distributed Database Systems; Fault Tolerance; Issues - Two-phase and Nonblocking Commit Protocols; Voting Protocols; Dynamic Voting Protocols
4. Multiprocessor System: Definition, Classification, Multiprocessor Interconnections, Types, Multiprocessor OS functions & requirements; Design & Implementation Issue; Introduction to parallel programming; Multiprocessor Synchronization. Real Time Operating systems: Fundamentals of real time operating systems, real time multitasking, embedded application, preemptive task scheduling, inter-task communication and synchronization. Analytic Modeling: Introductions, Queuing Theory, Markov Process.

Books:

1. OperatingSystemsConcepts &design-MilanMilenkovic,TMH
2. OperatingSystem- H.M. Deitel,Pearsons.
3. AdvancedConcepts inoperatingSystems-MukeshSinghal andNiranjanG.Shivaratri,TMH
4. Mukesh Singhal and N. G. Shivaratri, "Advanced Concepts in Operating Systems", McGraw- Hill, 2000
5. Abraham Silberschatz, Peter B. Galvin, G. Gagne, "Operating System Concepts", Sixth Addison n Wesley Publishing Co., 2003.

Raman Mani

Pre Ph.D. Course in Computer Science and Engineering
Big Data Analytics

L	T	P
4	0	0

1. An Overview of Big Data and Big Data Analytics. Understanding Hadoop Ecosystem (Hadoop Distributed File System, MapReduce, Hadoop YARN, HBase, Combining HBase and HDFS, Hive, Pig, Sqoop, ZooKeeper, Flume, Oozie). MapReduce Framework, Techniques to Optimize MapReduce Jobs, Role of HBase in Big Data Processing
2. Developing Simple MapReduce Application, Points to Consider while Designing MapReduce. Controlling MapReduce Execution with InputFormat, Reading Data with Custom RecordReader, Organizing Output Data with OutputFormats, Customizing Data with RecordWriter, Optimizing MapReduce Execution with Combiner, Controlling Reducer Execution with Partitioners.
3. YARN Architecture, Working of YARN, YARN Schedulers, Backward Compatibility with YARN, YARN Configurations, Commands, Containers. Introduction to NoSQL. Types of NoSQL Data Models, Schema-Less Databases, Materialized Views, Distribution Models.
4. Analytical Approaches, Introducing to various Analytical Tools, Installing R, Handling Basic Expressions in R, Variables in R, Working with Vectors, Storing and Calculating Values in R, Creating and Using Objects, Interacting with Users, Handling Data in R Workspace, Executing Scripts, Reading Datasets and Exporting Data from R, Manipulating and Processing Data in R, Working with Functions and Packages in R, Performing Graphical Analysis in R, Techniques Used for Visual Data Representation, Types of Data Visualization

Books:

1. Big Data, Black Book by DT Editorial Services, Dreamtech Press.
2. Big Data Computing and Communications edited by Yu Wang, Hui Xiong, Shlomo Argamon, XiangYang Li, JianZhong Li, Springer
3. Big Data Analytics Beyond Hadoop by Vijay Srinivas Agneeswaran, FT Press.

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Advanced Data Communication

L	T	P
4	0	0

1. Digital Modulation: Introduction, Information Capacity Bits, Bit Rate, Baud, and M-ARY Coding, ASK, FSK, PSK, QAM, BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

2.Basic Concepts of Data Communications, Interfaces and Modems: Data Communication Components, Networks, Distributed Processing, Network Criteria- Applications, Protocols and Standards, Standards Organizations- Regulatory Agencies, Line Configuration- Point-to-point Multipoint, Topology- Mesh- Star- Tree- Bus- Ring- Hybrid Topologies, Transmission Modes Simplex- Half duplex- Full Duplex, Categories of Networks- LAN, MAN, WAN and Internetworking, Digital Data Transmission- Parallel and Serial, DTE- DCE Interface- Data Terminal Equipment, Data Circuit- Terminating Equipment, Standards EIA 232 Interface, Other Interface Standards, Modems- Transmission Rates.

3. Error Detection and Correction: Types of Errors- Single- Bit Error, CRC (Cyclic Redundancy Check)- Performance, Checksum, Error Correction- Single-Bit Error Correction, Hamming Code. Data link Control: Stop and Wait, Sliding Window Protocols. Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocol- Binary Synchronous Communication (BSC) - BSC Frames- Data Transparency, Bit Oriented Protocols – HDLC, Link Access Protocols.

4. Switching: Circuit Switching- Space Division Switches- Time Division Switches- TDM Bus Space and Time Division Switching Combinations- Public Switched Telephone Network, Packet Switching, Circuit Switched Versus Virtual Circuit Connection, Message Switching.

5. Multiplexing: Time Division Multiplexing (TDM), Synchronous Time Division Multiplexing, Digital Hierarchy, Statistical Time Division Multiplexing. Multiple Access: Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Detection (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization- Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), - Code - Division Multiple Access (CDMA).

BOOKS:

1. Data Communication and Computer Networking - B. A.Forouzan, 3rded., 2008, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5 ed., 2008, PEI.
3. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
4. Data and Computer Communications - William Stallings, 8th ed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2nd Edition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2nd ed., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4/ed., Wiley-Interscience, John Wiley & Sons, 2004.

Raman Maini

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Internetworking

L	T	P
4	0	0

1. Internetworking concepts: Principles of Internetworking, Connectionless Internetworking, Application level Interconnections, Network level Interconnection, Properties of the Internet, Internet Architecture, Wired LANS, Wireless LANs, Point-to-Point WANs, Switched WANs, Connecting Devices, TCP/IP Protocol Suite. IP Address: Classful Addressing: Introduction, Classful Addressing, Other Issues, Sub-netting and Super-netting IP Address: Classless Addressing: - Variable length Blocks, Sub-netting, Address Allocation. Delivery, Forwarding, and Routing of IP Packets: Delivery, Forwarding, Routing, Structure of Router. ARP and RARP:ARP, ARP Package, RARP.
2. Internet Protocol (IP): Datagram, Fragmentation, Options, Checksum, IP V.6. Transmission Control Protocol (TCP): TCP Services, TCP Features, Segment, A TCP Connection, State Transition Diagram, Flow Control, Error Control, Congestion Control, TCP Times. Stream Control Transmission Protocol (SCTP): SCTP Services, SCTP Features, Packet Format, Flow Control, Error Control, Congestion Control. Mobile IP: Addressing, Agents, Three Phases, Inefficiency in Mobile IP. Classical TCP Improvements: Indirect TCP, Snooping TCP, Mobile TCP, Fast Retransmit/ Fast Recovery, Transmission/ Time Out Freezing, Selective Retransmission, Transaction Oriented TCP.
3. Unicast Routing Protocols (RIP, OSPF, and BGP): Intra and Inter-domain Routing, Distance Vector Routing, RIP, Link State Routing, OSPF, Path Vector Routing, BGP. Multicasting and Multicast Routing Protocols: Unicast - Multicast- Broadcast, Multicast Applications, Multicast Routing, Multicast Link State Routing: MOSPF, Multicast Distance Vector: DVMRP.
4. Domain Name System (DNS): Name Space, Domain Name Space, Distribution of Name Space, and DNS in the internet. Remote Login TELNET:- Concept, Network Virtual Terminal (NVT). File Transfer FTP and TFTP: File Transfer Protocol (FTP). Electronic Mail: SMTP and POP. Network Management-SNMP: Concept, Management Components. World Wide Web- HTTP Architecture. Multimedia: Digitizing Audio and Video, Network security, security in the internet firewalls. Audio and Video Compression, Streaming Stored Audio/Video, Streaming Live Audio/Video, Real-Time Interactive Audio/Video, RTP, RTCP, Voice Over IP. Network Security, Security in the Internet, Firewalls.

BOOKS:

1. TCP/IP Protocol Suite- Behrouz A. Forouzan, Third Edition, TMH.
2. Internetworking with TCP/IP Comer 3rd edition PHI.
3. High performance TCP/IP Networking- Mahbub Hassan, Raj Jain, PHI, 2005
4. Data Communications & Networking – B.A. Forouzan – 2^{nd} Edition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Optimization Techniques

L	T	P
4	0	0

1. Introduction to Optimization Techniques, Origin & development of O.R., Nature & Characteristic, features of O.R., Models & Modeling in Operation Research. Methodology of O.R.
2. Linear Programming - Mathematical Model, Assumptions of Linear Programming, Graphical Method, Principles of Simplex method and its Applications, Two Phase & Big M-method, Revised simplex method , Duality, Dual simplex method- Primal Dual Relationship and sensitivity analysis.
3. Linear Programming: Mathematical formation of linear programming problem, Special types of linear programming problems -Transportation and assignment problems, Unbalanced Assignment problems, Crew based assignment problems, Test for Optimality, Degeneracy in Transportation Problems, Unbalanced Transportation Problems.
4. Definition of Probability, Sample Space, Algebra of Events, Addition and multiplication law of probability, Conditional Probability. Dynamic Programming-Features and applications of dynamic programming.
5. Decision Theory, Integer Programming, Gomory Method and Branch & Bound Method.

Books:

1. Kapoor, V.K.: Operation Research, Sultan Chand & Co., New Delhi.
2. Man Mohan, Gupta P.K.: Operation Research, Sultan Chand & Co., New Delhi.
3. Pronsen, Richard: Theory and Problems of Operation Research, McGraw Hill, 1983.
4. Hiller, F.S. & Liberman, G.J., 1974: Introduction to Operations Research, 2nd Edn. Holden
5. Rao, S. S., 1978: Introduction to Optimization: Theory & Applications, Wiley Eastern.
6. Srinath, L.S.: Linear Programming, East-West, New Delhi.

Pawan Saini

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Adhoc Wireless and Sensor Networks

L	T	P
4	0	0

1. AD HOC Wireless Networks: Introduction, Issues in Ad Hoc Wireless Networks, AD Hoc Wireless Internet. MAC Protocols for Ad Hoc Wireless Networks: Introduction, Issues in Designing a MAC protocol for Ad Hoc Wireless Networks, Design goals of a MAC Protocol for Ad Hoc Wireless Networks, Classifications of MAC Protocols, Contention - Based Protocols, Contention - Based Protocols with reservation Mechanisms, Contention – Based MAC Protocols with Scheduling Mechanisms.

2. ROUTING PROTOCOLS: Introduction, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classification of Routing Protocols, Table –Driven Routing Protocols, On – Demand Routing Protocols, Hybrid Routing Protocols, Routing Protocols with Efficient Flooding Mechanisms, Hierarchical Routing Protocols, Power – Aware Routing Protocols. Transport layer and Security Protocols: Introduction, Issues in Designing a Transport Layer Protocol for Ad Hoc Wireless Networks, Design Goals of a Transport Layer Protocol for Ad Hoc Wireless Networks, Classification of Transport Layer Solutions, TCP Over Ad Hoc Wireless Networks, Other Transport Layer Protocol for Ad Hoc Wireless Networks.

3. QUALITY OF SERVICE: Introduction, Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks, Classification of QoS Solutions, MAC Layer Solutions, Network Layer Solutions, QoS Frameworks for Ad Hoc Wireless Networks. ENERGY MANAGEMENT: Introduction, Need for Energy Management in Ad Hoc Wireless Networks, Classification of Ad Hoc Wireless Networks, Battery Management Schemes.

4. WIRELESS SENSOR NETWORKS: Introduction, Sensor Network Architecture, Data Dissemination, Data Gathering, MAC Protocols for Sensor Networks, Location Discovery, Quality of a Sensor Network, Evolving Standards, Other Issues.

BOOKS: 1. Ad Hoc Wireless Networks: Architectures and Protocols - C. Siva Ram Murthy and B.S.Manoj, 2004, PHI.

2. Wireless Ad- hoc and Sensor Networks: Protocols, Performance and Control Jagannathan Sarangapani, CRC Press.

3. Ad- Hoc Mobile Wireless Networks: Protocols & Systems, C.K. Toh ,1 ed. Pearson Education.

4. Wireless Sensor Networks - C. S. Raghavendra, Krishna M. Sivalingam, 2004, Springer

Damay Maini

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Neural Networks and Fuzzy Logic

L	T	P
4	0	0

1. Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN – Training, Learning and Generalization.
2. Supervised Learning: Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feedforward Network, Radial- Basis Function (RBF) network & its learning strategies.
3. Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's, Self-organizing Maps.
Neurodynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-aBox network, Bidirectional associative memories.
4. Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic.

Books:

1. Satish Kumar,"Neural Network : A classroom approach", Tata McGraw Hill.
2. Jacek M.Zurada," Artificial Neural Networks", West Publication.
3. Rajasekaran & Pai,"Neural networks, Fuzzy logic and genetic algorithms", PHI learning Pvt. Ltd.

Raman Maini

Inter Disciplinary course

Pre Ph.D. Course in Computer Science and Engineering
Mathematical Foundations of Computer Networks

L	T	P
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1. Basic algorithms on directed graphs, weighted shortest paths.

2. Networks and routing algebras - fixed-point equations, sequential algorithm to solve the fixed-point equations, generalized distance-vector and link-state routing protocols.

3. Applications to quality-of service intra-domain routing and to policy-based inter-domain routing in the Internet.

4. Network flows - flows and residual networks, Max-flow Min-cut theorem, Ford Fulkerson method and Edmonds-Karp algorithm.

5. Network calculus- Min-plus calculus: integrals and convolutions, Arrival curves and token buckets; service curves and schedulers, Applications to integrated and differentiated services in the Internet.

Books:

1. Thomas Cormen, Charles Leiserson, Ronald Rivest, and Clifford Stein. Introduction to algorithms, 2th edition. The MIT Press 2001 [Chapter VI]
2. Jorgen Bang-Jensen and Gregory Gutin. Digraphs: theory, algorithms and applications. Springer, 2002 [Section 7.3 and 9.5]
3. J. L. Sobrinho, An algebraic theory of dynamic network routing, IEEE/ACM Transactions on Networking, 13(5), October 2005.
4. Jean-Yves Le Boudec and Patrick Thiran. Network calculus. Springer, 2006. [Chapter 1, 2, and 3]