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**Supporting Documents-**  
**Department of Computer Science &**  
**Engineering**

**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:**

**First Semester**

Course Code	Course Type	Course Title	Load allocation			Marks Distribution		Total Marks	Credits
			L*	T*	P	Internal	External		
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				40	60	100	
			3	0	0				3
MTCS 106-18		Wireless Sensor Networks							
MTCS 107-18		Introduction to Intelligent Systems							
MTCS 108-18	Program Elective II	Data Science				40	60	100	
MTCS 109-18		Distributed Systems	3	0	0				3
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
	<b>TOTAL</b>		<b>16</b>	<b>0</b>	<b>8</b>	<b>320</b>	<b>380</b>	<b>700</b>	<b>18</b>

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

**IKG GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA**

**M. TECH, COMPUTER SCIENCE & ENGINEERING**

**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
	<b>TOTAL</b>		<b>16</b>	<b>0</b>	<b>8</b>	<b>320</b>	<b>380</b>	<b>700</b>	<b>18</b>

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

**Third Semester**

Course Code	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 Management of 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
	<b>TOTAL</b>		<b>6</b>	<b>0</b>	<b>20</b>	<b>200</b>	<b>200</b>	<b>400</b>	<b>16</b>

\*\* This is to be taken up after 2<sup>nd</sup> 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
	<b>TOTAL</b>		<b>0</b>	<b>0</b>	<b>32</b>	<b>60</b>	<b>40</b>	<b>100</b>	<b>16</b>

\*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 the desired 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:**

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

Total Number of Lectures:48

**COURSE OBJECTIVE**

0 To understand the mathematical fundamentals that is prerequisites for a variety of courses like

Data mining, Network protocols, analysis of Web traffic, Computer security, Software engineering, Computer architecture, operating systems, distributed systems, Bioinformatics, Machine learning.

0 To develop the understanding of the mathematical and logical basis to many modern techniques in information technology like machine learning, programming language design, and concurrency.

0 To study various sampling and classification problems.

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<b>Unit 1</b> 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, Markov chains.	7
<b>Unit 2</b> Random samples, sampling distributions of estimators, Methods of Moments and Maximum Likelihood.	7
<b>Unit 3</b> Statistical inference, Introduction to multivariate statistical models: regression and classification problems, principal components analysis, The problem of overfitting model assessment.	8
<b>Unit 4</b> 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



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

<b>COURSE OUTCOMES</b>
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

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

Total Number of Lectures:48

<b>COURSE OBJECTIVE</b>
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.
	<b>LECTURE WITH BREAKUP</b>
	<b>NO. OF LECTURES</b>
<b>Unit 1</b>	7
<b>Dictionaries:</b> Definition, Dictionary Abstract Data Type, Implementation of Dictionaries.	
<b>Hashing:</b> Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Linear Probing, Quadratic, Probing, Double Hashing, Rehashing, Extendible Hashing.	
<b>Unit 2</b>	5
<b>Skip Lists:</b> Need for Randomizing Data Structures and Algorithms, Search and Update Operations on Skip Lists, Probabilistic Analysis of Skip Lists, Deterministic Skip Lists	
<b>Unit 3</b>	9
<b>Trees:</b> Binary Search Trees, AVL Trees, Red Black Trees, 2-3 Trees, B-Trees, Splay Trees	
<b>Unit 4</b>	12
<b>Text Processing:</b> 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.	
<b>Unit 5</b>	10
<b>Computational Geometry:</b> One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quadrees, k-D Trees.	
<b>Unit 6</b>	5
Recent Trends in Hashing, Trees, and various computational geometry methods for efficiently solving the new evolving problem.	

<b>COURSE OUTCOMES</b>
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.

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

Total Number of Lectures:48

<b>COURSE OBJECTIVE</b>
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.

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<p><b>Unit1</b></p> <p><b>Sorting:</b> Review of various sorting algorithms, topological sorting</p> <p><b>Graph:</b> 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.</p>	6
<p><b>Unit 2</b></p> <p><b>Matroids:</b> Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set. Application to MST.</p> <p><b>Graph Matching:</b> Algorithm to compute maximum matching. Characterization of maximum matching by augmenting paths, Edmond's Blossom algorithm to compute augmenting path.</p>	8

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

<b>COURSE OUTCOMES</b>
<p>After completion of course, students would be able to:</p> <ul style="list-style-type: none"> <li>0 Analyze the complexity/performance of different algorithms.</li> <li>0 Determine the appropriate data structure for solving a particular set of problems.</li> <li>0 Categorize the different problems in various classes according to their complexity.</li> <li>0 Students should have an insight of recent activities in the field of the advanced data structure.</li> </ul>



**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.
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<b>Research Methodology and IPR</b>	
<b>Course Code: MTRM-101-18, Credits :2</b>	
Lectures: 1hrs/week	
<b>Course Outcomes:</b>	
<p>At the end of this course, students will be able to</p> <ul style="list-style-type: none"> <li>0 Understand research problem formulation.</li> <li>0 Analyze research related information</li> <li>0 Follow research ethics</li> <li>0 Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.</li> <li>0 Understanding that when IPR would take such important place in growth of individuals &amp; nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general &amp; engineering in particular.</li> <li>0 Understand that IPR protection provides an incentive to inventors for further research work and investment in R &amp; D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.</li> </ul>	
<b>Syllabus Contents:</b>	
<p><b>Unit 1:</b> 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.</p> <p>Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations</p> <p><b>Unit 2:</b> Effective literature studies approaches, analysis Plagiarism, Research ethics,</p> <p><b>Unit 3:</b> Effective technical writing, how to write report, Paper</p> <p>Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee</p> <p><b>Unit 4:</b> 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.</p> <p><b>Unit 5:</b> Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.</p> <p><b>Unit 6:</b> 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.</p>	





**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
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**IKG GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA**

**M. TECH, COMPUTER SCIENCE & ENGINEERING**

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

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>	
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.

<b>LECTURE WITH BREAKU</b>	<b>NO. OF LECTURES</b>
<b>Unit 1:</b> <b>INTRODUCTION TO SOFT COMPUTING AND NEURAL NETWORKS:</b> Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence: Machine Learning Basics.	7
<b>Unit 2</b> <b>FUZZY LOGIC:</b> 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
<b>Unit 3</b> <b>NEURAL NETWORKS:</b> 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
<b>Unit 4</b> <b>GENETIC ALGORITHMS:</b> Introduction to Genetic Algorithms (GA), Applications of GA in Machine Learning: Machine Learning Approach to Knowledge Acquisition.	5
<b>Unit 5</b> <b>Matlab/Python Lib:</b> 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



<b>Unit 6</b>	5
Recent Trends in deep learning, various classifiers, neural networks and genetic algorithm. Implementation of recently proposed soft computing techniques.	

<b>COURSE OUTCOMES</b>
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

<b>Course Code</b>	MTCS 105-18
<b>Course Name</b>	Machine learning
<b>Credits</b>	3
<b>Pre-Requisites</b>	

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
<b>Unit 1:</b>  <b>Supervised Learning (Regression/Classification)</b> <ul style="list-style-type: none"> <li>0 Basic methods: Distance-based methods, Nearest-Neighbours, Decision Trees, Naive Bayes</li> <li>0 Linear models: Linear Regression, Logistic Regression, Generalized Linear Models</li> <li>0 Support Vector Machines, Nonlinearity and Kernel Methods</li> <li>0 Beyond Binary Classification: Multi-class/Structured Outputs, Ranking</li> </ul>	10





<p><b>Unit 2:</b></p> <p><b>Unsupervised Learning</b></p> <ul style="list-style-type: none"> <li>• Clustering: K-means/Kernel K-means</li> <li>• Dimensionality Reduction: PCA and kernel PCA</li> <li>• Matrix Factorization and Matrix Completion</li> <li>• Generative Models (mixture models and latent factor models)</li> </ul>	7
<p><b>Unit 3</b></p> <p>Evaluating Machine Learning algorithms and Model Selection, Introduction to Statistical Learning Theory, Ensemble Methods (Boosting, Bagging, RandomForests).</p>	6
<p><b>Unit 4</b></p> <p>Sparse Modeling and Estimation, Modeling Sequence/Time-Series Data, Deep Learning and Feature Representation Learning.</p>	9
<p><b>Unit 5</b></p> <p>Scalable Machine Learning (Online and Distributed Learning)</p> <p>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.</p>	9
<p><b>Unit 6:</b></p> <p>Recent trends in various learning techniques of machine learning and classification methods for IOT applications. Various models for IOT applications.</p>	5

<b>COURSE OUTCOMES</b>
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
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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.
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**IKG GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA**

**M. TECH, COMPUTER SCIENCE & ENGINEERING**

<b>Course Code</b>	MTCS106-18
<b>Course Name</b>	Wireless Sensor Networks
<b>Credits</b>	3
<b>Pre-Requisites</b>	Wireless Communication

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
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.

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



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

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be able to:</b>
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





**IKG GUJRAL PUNJAB TECHNICAL UNIVERSITY, KAPURTHALA**

**M. TECH, COMPUTER SCIENCE & ENGINEERING**

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

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
<p>0 The aim of the course is to introduce to the field of Artificial Intelligence (AI) with emphasis on its use to solve real world problems for which solutions are difficult to express using the traditional algorithmic approach. It explores the essential theory behind methodologies for developing systems that demonstrate intelligent behaviour including dealing with uncertainty, learning from experience and following problem solving</p>

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<p><b>Unit 1:</b> Biological foundations to intelligent systems I: Artificial neural networks, Back-propagation networks, Radial basis function networks, and recurrent networks.</p>	9
<p><b>Unit 2:</b> Biological foundations to intelligent systems II: Fuzzy logic, knowledge Representation and inference mechanism, genetic algorithm, and fuzzy neural networks.</p>	6
<p><b>Unit 3:</b> 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.</p>	7
<p><b>Unit 4:</b> 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.</p>	9
<p><b>Unit 5:</b> 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.</p>	7



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<b>Unit 6:</b> Recent trends in Fuzzy logic, Knowledge Representation.	5
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<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>
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.

<b>Course Code</b>	MTCS108-18
<b>Course Name</b>	Data Science
<b>Credits</b>	3
<b>Pre-Requisites</b>	

Total Number of Lectures:48

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<b>COURSE OBJECTIVE</b>
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;

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<b>Unit 1:</b> Introduction to core concepts and technologies: Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.	6
<b>Unit 2:</b> 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
<b>Unit 3:</b> 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
<b>Unit 4:</b> Data visualization: Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.	11
<b>Unit 5:</b> Applications of Data Science, Technologies for visualization, Bokeh (Python)	7
<b>Unit 6:</b> Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.	7

<b>COURSE OUTCOMES</b>
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<b>On completion of the course the student should be able to</b>	
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 from the Frontline. O’Reilly.
2. Jure Leskovek, Annand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.

<b>Course Code</b>	MTCS109-18
<b>Course Name</b>	Distributed Systems
<b>Credits</b>	3
<b>Pre-Requisites</b>	Database Management Systems

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
<ul style="list-style-type: none"><li>• To introduce the fundamental concepts and issues of managing large volume of shared data in a parallel and distributed environment, and to provide insight into related research problems.</li></ul>

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<b>Unit 1: INTRODUCTION</b>  Distributed data processing; What is a DDDBS; Advantages and disadvantages of DDDBS; Problem areas; Overview of database and computer network concepts  <b>DISTRIBUTED DATABASE MANAGEMENT SYSTEM ARCHITECTURE</b>  Transparencies in a distributed DBMS; Distributed DBMS architecture; Global directory issues.	8





<p><b>Unit 2:</b></p> <p><b>DISTRIBUTED DATABASE DESIGN</b></p> <p>Alternative design strategies; Distributed design issues; Fragmentation; Data allocation.</p> <p><b>SEMANTICS DATA CONTROL</b></p> <p>View management; Data security; Semantic Integrity Control.</p> <p><b>QUERY PROCESSING ISSUES</b></p> <p>Objectives of query processing; Characterization of query processors; Layers of query processing; Query decomposition; Localization of distributed data.</p>	11
<p><b>Unit 3:</b></p> <p><b>DISTRIBUTED QUERY OPTIMIZATION</b></p> <p>Factors governing query optimization; Centralized query optimization; Ordering of fragment queries; Distributed query optimization algorithms.</p> <p><b>TRANSACTION MANAGEMENT</b></p> <p>The transaction concept; Goals of transaction management; Characteristics of transactions; Taxonomy of transaction models.</p> <p><b>CONCURRENCY CONTROL</b></p> <p>Concurrency control in centralized database systems; Concurrency control in DDBSs; Distributed concurrency control algorithms; Deadlock management.</p>	11
<p><b>Unit 4:</b></p> <p><b>RELIABILITY</b></p> <p>Reliability issues in DDBSs; Types of failures; Reliability techniques; Commit protocols; Recovery protocols.</p>	8
<p><b>Unit 5:</b></p> <p><b>PARALLEL DATABASE SYSTEMS</b></p> <p>Parallel architectures; parallel query processing and optimization; load balancing.</p>	6



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<b>Unit 6:</b>  <b>ADVANCED TOPICS</b>  Mobile Databases, Distributed Object Management, Multi-databases.	4
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<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>
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. Ozu and P. Valduriez, Prentice-Hall, 1991.
2. Distributed Database Systems, D. Bell and J. Grimson, Addison-Wesley, 1992.

<b>Course Code</b>	MTCS110-18
<b>Course Name</b>	Advanced Wireless and Mobile Networks
<b>Credits</b>	3
<b>Pre-Requisites</b>	Computer Networks

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
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.

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LECTURE WITH BREAKUP	NO. OF LECTURES
<p><b>Unit 1: INTRODUCTION:</b></p> <p>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.</p> <p><b>WIRELESS LOCAL AREA NETWORKS:</b></p> <p>IEEE 802.11 Wireless LANs Physical &amp; MAC layer, 802.11 MAC Modes (DCF&amp; PCF) IEEE 802.11 standards, Architecture &amp; protocols, Infrastructure vs. Adhoc Modes, Hidden Node &amp; Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.</p>	11
<p><b>Unit 2:</b></p> <p><b>WIRELESS CELLULAR NETWORKS:</b></p> <p>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.</p>	10
<p><b>Unit 3:</b></p> <p>WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview</p> <p><b>WIRELESS SENSOR NETWORKS</b></p> <p>Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.</p>	8
<p><b>Unit 4: WIRELESS PANS</b></p> <p>Bluetooth AND Zigbee, Introduction to Wireless Sensors.</p>	4
<p><b>Unit 5: SECURITY</b></p> <p>Security in wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in wireless communication.</p>	10



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<b>Unit 6:</b>	
<b>ADVANCED TOPICS</b>	5
IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks	

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>
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
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<b>Course Code</b>	MTCS206-18
<b>Course Name</b>	Data Preparation and Analysis
<b>Credits</b>	3
<b>Pre-Requisites</b>	

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
<ul style="list-style-type: none"><li>• To prepare the data for analysis and develop meaningful Data Visualizations</li></ul>

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

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>

0 Able to extract the data for performing the Analysis.

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**References:**

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

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

Total Number of Lectures:48

<b>COURSE OBJECTIVE</b>
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.

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

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<p><b>Unit 2:</b></p> <p><b>Enterprise Application Development</b></p> <p>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.</p>	11
<p><b>Unit 3:</b></p> <p><b>Enterprise Systems Administration</b></p> <p>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).</p>	8
<p><b>Unit 4:</b></p> <p>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.</p>	8
<p><b>Unit 5:</b></p> <p>Handle insecure exceptions and command/SQL injection, Defend web and mobile applications against attackers, software containing minimum vulnerabilities and flaws.</p>	9
<p><b>Unit 6:</b></p> <p>Case study of DNS server, DHCP configuration and SQL injection attack.</p>	4

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be able to:</b>
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.



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**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.

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

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
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 Understand the geometric relationships between 2D images and the 3D world.
0 Grasp the principles of state-of-the-art deep neural networks.

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

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<b>Unit 5:</b> 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
<b>Unit 6:</b> Recent trends in Activity Recognition, computational photography, Biometrics.	4

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be able to:</b>
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 of Computer Vision and Image Processing, by Fisher et al.

<b>Course Code</b>	MTCS209-18
<b>Course Name</b>	Human and Computer Interaction
<b>Credits</b>	3
<b>Pre-Requisites</b>	

Total Number of Lectures: 48

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<b>COURSE OBJECTIVE</b>
<ul style="list-style-type: none"> <li>0 Learn the foundations of Human Computer Interaction</li> <li>0 Be familiar with the design technologies for individuals and persons with disabilities</li> <li>0 Be aware of mobile Human Computer interaction.</li> <li>0 Learn the guidelines for user interface.</li> </ul>

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<b>Unit 1:</b> 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
<b>Unit 2:</b> 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
<b>Unit 3:</b> Cognitive models –Socio-Organizational issues and stake holder requirements –Communication and collaboration models-Hypertext, Multimedia and <a href="http://www">WWW</a> .	8
<b>Unit 4:</b> 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
<b>Unit 5:</b> Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.	8
<b>Unit 6:</b> Recent Trends: Speech Recognition and Translation, Multimodal System.	3

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>



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- 0 Understand the structure of models and theories of human computer interaction and vision.\
- 0 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)

<b>Course Code</b>	MTCS210-18
<b>Course Name</b>	GPU Computing
<b>Credits</b>	3
<b>Pre-Requisites</b>	

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
0 To learn parallel programming with Graphics Processing Units (GPUs).

LECTURE WITH BREAKUP	NO. OF LECTURES
<p><b>Unit 1:</b></p> <p><b>Introduction:</b> 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,</p>	
<p>Warps/ Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 13 1D / 2D/ 3D thread mapping, Device properties, Simple Programs.</p> <p><b>Unit 2:</b></p> <p><b>Memory:</b> Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-</p>	

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

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<p><b>Unit 3:</b></p> <p><b>Synchronization:</b> 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 <b>Functions:</b> Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.</p>	10
<p><b>Unit 4:</b></p> <p><b>Support:</b> Debugging GPU Programs. Profiling, Profile tools, Performance aspects</p> <p><b>Streams:</b> Asynchronous processing, tasks, Task-dependence, Overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based- Synchronization - Overlapping data transfer and kernel execution, pitfalls.</p>	8
<p><b>Unit 5:</b></p> <p><b>Case Studies:</b> Image Processing, Graph algorithms, Simulations, Deep Learning.</p>	5
<p><b>Unit 6:</b></p> <p><b>Advanced topics:</b> Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing.</p>	5

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>
0 Students would learn concepts 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-mei Hwu; 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)

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

Total Number of Lectures: 48





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<b>COURSE OBJECTIVE</b>
0 Provides an in-depth study of the rapidly changing and fascinating field of computer forensics.
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.

<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<p><b>Unit 1:</b></p> <p><b>Digital Forensics Science:</b> Forensics science, computer forensics, and digital forensics.</p> <p><b>Computer Crime:</b> Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics.</p>	9
<p><b>Unit 2:</b></p> <p><b>Cyber Crime Scene Analysis:</b> 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.</p>	8
<p><b>Unit 3:</b></p> <p><b>Evidence Management &amp; Presentation:</b> 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.</p>	9
<p><b>Unit 4:</b></p> <p><b>Computer Forensics:</b> Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, Complete a case, Critique a case,</p> <p><b>Network Forensics:</b> open-source security tools for network forensic analysis, requirements for preservation of network data.</p>	10



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

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be able to:</b>
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

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

Total Number of Lectures:48

<b>COURSE OBJECTIVE</b>
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

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<b>LECTURE WITH BREAKUP</b>	<b>NO. OF LECTURES</b>
<p><b>Unit 1:</b></p> <p><b>Introduction:</b>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.</p>	8
<p><b>Unit 2:</b></p> <p><b>More on Uis:</b> 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.</p>	8
<p><b>Unit 3:</b></p> <p><b>Communications via Network and the Web:</b>State Machine, Correct Communications Model, Android Networking and Web, Telephony Deciding Scope of an App, Wireless Connectivity and Mobile Apps, Android Telephony.</p> <p><b>Notifications and Alarms:</b>Performance, Performance and Memory Management, Android Notifications and Alarms, Graphics, Performance and Multithreading, Graphics and UI Performance, Android Graphics.</p>	10
<p><b>Unit 4:</b></p> <p><b>Putting It All Together:</b> Packaging and Deploying, Performance Best Practices, Android Field Service App, Location Mobility and Location Based Services Android.</p> <p><b>Multimedia:</b> Mobile Agents and Peer-to-Peer Architecture, Android Multimedia.</p>	9
<p><b>Unit 5:</b></p> <p><b>Platforms and Additional Issues:</b> Development Process, Architecture, Design, Technology Selection, Mobile App Development Hurdles, Testing, Security and Hacking, Active Transactions, More on Security, Hacking Android.</p>	8
<p><b>Unit 6:</b></p> <p>Recent trends in Communication protocols for IOT nodes, mobile computing techniques in IOT, agents based communications in IOT.</p>	5
<b>COURSE OUTCOMES</b>	
0 On completion of the course the student should be able to identify the target platform and users and be able to define and sketch a mobile application.	



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|--|
| 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

**COURSE OBJECTIVE**

- The objective of this course is to introduce the structure of compilers and high performance compiler design to students. Concepts of cache coherence and parallel loops in compilers are included.

LECTURE WITH BREAKUP	NO. OF LECTURES
<b>Unit1:</b> <b>High Performance Systems</b> , Structure of a Compiler, Programming Language Features, Languages for High Performance.	7
<b>Unit2:</b> <b>Data Dependence:</b> Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. <b>Scalar Analysis with Factored Use-Def Chains:</b> 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

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

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

**References:**



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

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

Total Number of Lectures: 48

<b>COURSE OBJECTIVE</b>
0 The objective of this course is to provide insight to the mathematical formulation of real world problems.
0 To optimize these mathematical problems using nature based algorithms. And the solution is useful specially for NP-Hard problems.

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

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

<b>COURSE OUTCOMES</b>
<b>After completion of course, students would be:</b>
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**



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**Business Analytics**

Teaching scheme Lecture: - 3 h/week

<b>Course Code</b>	MTOE301-18
<b>Course Name</b>	<b>Business Analytics</b>
<b>Credits Prerequisites</b>	

Total Number of Lectures: 48

<b>Course objective</b>
<ol style="list-style-type: none"><li>1. Understand the role of business analytics within an organization.</li><li>2. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.</li><li>3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.</li><li>4.</li><li>5.</li><li>6. To become familiar with processes needed to develop, report, and analyze business data.</li><li>7. Use decision-making tools/Operations research techniques. Manage business process using analytical and management tools. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.</li></ol>

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LECTURE WITH BREAKUP	NO. OFLECTURES
<p><b>Unit1:</b></p> <p>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.</p> <p>Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.</p>	9
<p><b>Unit 2:</b></p> <p>Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression.</p> <p>Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.</p>	8
<p><b>Unit 3:</b></p> <p>Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.</p> <p>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.</p>	9
<p><b>Unit 4:</b></p> <p>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.</p> <p>Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation UsingAnalytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.</p>	10



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

<b>COURSE OUTCOMES</b>	
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.

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**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 tree concept, 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 one machine 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**

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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

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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.
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### 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 ply 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.
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**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.
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**AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING**

<b>Course objectives:</b>		
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		
<b>Syllabus</b>		
<b>Units</b>	<b>CONTENTS</b>	<b>Hours</b>
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



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

**AUDIT 1 and 2: DISASTER MANAGEMENT**

<b>Course Objectives:</b> -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.		
<b>Syllabus</b>		
Units	CONTENTS	Hours
1	<b>Introduction</b>  Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.	4
2	<b>Repercussions Of Disasters And Hazards:</b>  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	<b>Disaster Prone Areas In India</b>  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



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4	<b>Disaster Preparedness And Management</b> 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	<b>Risk Assessment</b> 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	<b>Disaster Mitigation</b> 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



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

**Syllabus**

Unit	Content	Hours
1	<ul style="list-style-type: none"><li>Alphabets in Sanskrit,</li><li>Past/Present/Future Tense,</li><li>Simple Sentences</li></ul>	8
2	<ul style="list-style-type: none"><li>Order</li><li>Introduction of roots</li><li>Technical information about Sanskrit Literature</li></ul>	8
3	<ul style="list-style-type: none"><li>Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics</li></ul>	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
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**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	<ul style="list-style-type: none"><li>• Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.</li><li>0 Moral and non- moral valuation. Standards and principles.</li><li>0 Value judgements</li></ul>	4
2	<ul style="list-style-type: none"><li>• Importance of cultivation of values.</li><li>• Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.</li><li>• Honesty, Humanity. Power of faith, National Unity.</li><li>• Patriotism, Love for nature ,Discipline</li></ul>	6



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3	<ul style="list-style-type: none"><li>● Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.</li><li>● Punctuality, Love and Kindness.</li><li>● Avoid fault Thinking.</li><li>● Free from anger, Dignity of labour.</li><li>● Universal brotherhood and religious tolerance.</li><li>● True friendship.</li><li>● Happiness Vs suffering, love for truth.</li><li>● Aware of self-destructive habits.</li><li>● Association and Cooperation.</li><li>● Doing best for saving nature</li></ul>	6
4	<ul style="list-style-type: none"><li>● Character and Competence –Holy books vs Blind faith.</li><li>● Self-management and Good health.</li><li>● Science of reincarnation.</li><li>● Equality, Nonviolence, Humility, Role of Women.</li><li>● All religions and same message.</li><li>● Mind your Mind, Self-control.</li><li>● Honesty, Studying effectively</li></ul>	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



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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' constitutional role 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**

<b>Units</b>	<b>Content</b>	<b>Hours</b>
1	<ul style="list-style-type: none"><li>• <b>History of Making of the Indian Constitution:</b><ul style="list-style-type: none"><li>• History</li><li>• Drafting Committee, ( Composition &amp; Working)</li></ul></li></ul>	4
2	<ul style="list-style-type: none"><li>• <b>Philosophy of the Indian Constitution:</b><ul style="list-style-type: none"><li>• Preamble Salient Features</li></ul></li></ul>	4



3	<ul style="list-style-type: none"><li>• <b>Contours of Constitutional Rights &amp; Duties:</b><ul style="list-style-type: none"><li>• Fundamental Rights</li><li>• Right to Equality</li><li>• Right to Freedom</li><li>• Right against Exploitation</li><li>• Right to Freedom of Religion</li><li>• Cultural and Educational Rights</li><li>• Right to Constitutional Remedies</li><li>• Directive Principles of State Policy</li><li>• Fundamental Duties.</li></ul></li></ul>	4
4	<ul style="list-style-type: none"><li>• <b>Organs of Governance:</b><ul style="list-style-type: none"><li>• Parliament</li><li>• Composition</li><li>• Qualifications and Disqualifications</li><li>• Powers and Functions</li><li>• Executive</li><li>• President</li><li>• Governor</li><li>• Council of Ministers</li><li>• Judiciary, Appointment and Transfer of Judges, Qualifications</li><li>• Powers and Functions</li></ul></li></ul>	4





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<b>5</b>	<ul style="list-style-type: none"><li>• <b>Local Administration:</b><ul style="list-style-type: none"><li>• District's Administration head: Role and Importance,</li><li>• Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation.</li><li>• Pachayati raj: Introduction, PRI: ZilaPachayat.</li><li>• Elected officials and their roles, CEO ZilaPachayat: Position and role.</li><li>• Block level: Organizational Hierarchy (Different departments),</li><li>• Village level: Role of Elected and Appointed officials,</li><li>• importance of grass root democracy</li></ul></li></ul>	<b>4</b>
<b>6</b>	<ul style="list-style-type: none"><li>• <b>Election Commission:</b><ul style="list-style-type: none"><li>• Election Commission: Role and Functioning.</li><li>• Chief Election Commissioner and Election Commissioners.</li><li>• State Election Commission: Role and Functioning.</li><li>• Institute and Bodies for the welfare of SC/ST/OBC and women.</li></ul></li></ul>	<b>4</b>

**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.
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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**

<b>Course Objectives:</b>		
Students will be able to:		
<ol style="list-style-type: none"><li>1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the Dfid, other agencies and researchers.</li><li>2. Identify critical evidence gaps to guide the development.</li></ol>		
<b>Syllabus</b>		
Units	Content	Hours
1	<b>0 Introduction and Methodology:</b>  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	<b>0 Thematic overview:</b>  • Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.  • Curriculum, Teacher education.	2



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3	<ul style="list-style-type: none"><li>• Evidence on the effectiveness of pedagogical practices</li><li>• Methodology for the in depth stage: quality assessment of included studies.</li><li>• How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?</li><li>• Theory of change.</li><li>• Strength and nature of the body of evidence for effective pedagogical practices.</li><li>• Pedagogic theory and pedagogical approaches.</li><li>• Teachers' attitudes and beliefs and Pedagogic strategies.</li></ul>	4
4	<ul style="list-style-type: none"><li>• Professional development: alignment with classroom practices and follow- up support</li><li>• Peer support</li><li>• Support from the head teacher and the community.</li><li>• Curriculum and assessment</li><li>• Barriers to learning: limited resources and large class sizes</li></ul>	4
5	<ul style="list-style-type: none"><li>• <b>Research gaps and future directions</b><ul style="list-style-type: none"><li>• Research design</li><li>• Contexts</li><li>• Pedagogy</li><li>• Teacher education</li><li>• Curriculum and assessment</li><li>• Dissemination and research impact.</li></ul></li></ul>	2

**Suggested reading**

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

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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](http://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
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**Syllabus**

<b>Unit</b>	<b>Content</b>	<b>Hours</b>
1	<ul style="list-style-type: none"><li>• Definitions of Eight parts of yog. ( Ashtanga )</li></ul>	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	<ul style="list-style-type: none"><li>• Asan and Pranayam</li></ul> 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
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**Syllabus**

<b>Unit</b>	<b>Content</b>	<b>Hours</b>
1	Neetisatakam-Holistic development of personality <ul style="list-style-type: none"><li>• Verses- 19,20,21,22 (wisdom)</li><li>• Verses- 29,31,32 (pride &amp; heroism)</li><li>• Verses- 26,28,63,65 (virtue)</li><li>• Verses- 52,53,59 (dont's)</li><li>• Verses- 71,73,75,78 (do's)</li></ul>	8
2	<ul style="list-style-type: none"><li>• Approach to day to day work and duties.</li><li>• Shrimad BhagwadGeeta : Chapter 2-Verses 41, 47,48,</li><li>• Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,</li><li>• Chapter 18-Verses 45, 46, 48.</li></ul>	8
3	<ul style="list-style-type: none"><li>• Statements of basic knowledge.</li><li>• Shrimad BhagwadGeeta: Chapter2-Verses 56, 62, 68</li><li>• Chapter 12 -Verses 13, 14, 15, 16,17, 18</li><li>• Personality of Role model. Shrimad BhagwadGeeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,</li><li>• Chapter 4-Verses 18, 38,39</li></ul>	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

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

**By**

**Board of Study- CSE; on 27<sup>th</sup> 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  $k \leq n$  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 Elective I & 2 hours for Lab based on Elective II**

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# 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 softwares**

#### **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.

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**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**



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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 should be able to:

- a. Read data sets into R, save them, and examine their contents.

Tasks you will complete in this Cycle include:

- a. Invoke the R environment and examine the R workspace.
- b. Create tables 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 the tasks in this Cycle you should be able to:

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

Tasks you will complete in this Cycle include:

- a. Reload datasets into the R statistical package.
- b. Perform summary statistics on the data.
- c. Remove outliers from the data.
- d. Plot the data using R.
- e. Plot the data using lattice and ggplot.

#### **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 be able to:

- a. Use R functions to create K-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 the K-means Clustering algorithm using graphic capabilities in 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 the K-means Clustering algorithm.

#### **Expt. 4: Association Rules**

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

- a. Use R functions for Association Rule based models.
- Tasks you will complete in this Cycle include:



a. Use the R-Studio environment to code Association Rule models.

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- b. Apply constraints in the Market Basket Analysis methods such as minimum thresholds on support and confidence measures that can be used to select interesting rules from the set of all possible rules.
- c. Use R graphics "arules" to execute and inspect the model and the effect of the various thresholds.

**Expt. 5: Linear Regression**

- a. This Cycle is designed to investigate and practice linear regression. After completing the tasks in This Cycle you should be 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 in This Cycle include:

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

**Expt. 7: Naïve Bayesian Classifier**

This Cycle is designed to investigate and practice Naive Bayesian classifier. After completing the tasks in This Cycle you should be 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 This Cycle include:

- a. Use R-Studio environment to code the Naïve Bayesian Classifier
- b. Use the ODBC connection to the "census" database to create a training data set for Naïve Bayesian Classifier from the big data.
- c. Use the Naive Bayesian Classifier program and evaluate how 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 be able to:

- a. Use R functions for Decision Tree models.
- b. Predict the outcome of an attribute based on the model.

Tasks you will complete in This Cycle include:

- a. Use the R-Studio environment to code Decision Tree Models.
  - b. Build a Decision Tree Model based on data whose schema is composed of attributes.
  - c. Predict the outcome of one attribute based on the model.
-



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**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 operations 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 clustering techniques to cluster the data.

**Expt. 8:** Apply various association rule mining algorithms.

**Expt. 9:** Implement classification using Decision tree.

**Expt. 10:** Apply Visualization methods 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.

## Secure Software Design and Enterprise Computing

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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





## IK Gujral Punjab Technical University

### M. Tech; Computer Science Engineering

- 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.

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## **IK Gujral Punjab Technical University**

### **M. Tech; Computer Science Engineering**

#### **ELECTIVE – IV**

##### **Human and Computer Interaction Lab: Programs may be implemented using C., 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

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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.

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# **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
	<b>TOTAL</b>		<b>13</b>	<b>3</b>	<b>16</b>	<b>460</b>	<b>440</b>	<b>900</b>	<b>25</b>

**\*\*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
	<b>TOTAL</b>		<b>11</b>	<b>3</b>	<b>13</b>	<b>365</b>	<b>360</b>	<b>725</b>	<b>21</b>

**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
	<b>TOTAL</b>		<b>12</b>	<b>3</b>	<b>15</b>	<b>395</b>	<b>380</b>	<b>775</b>	<b>23</b>

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

**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
	<b>TOTAL</b>		<b>12</b>	<b>03</b>	<b>15</b>	<b>395</b>	<b>380</b>	<b>775</b>	<b>23</b>
<b>Students will undergo 4 weeks Institutional Summer Training* after 4<sup>th</sup> semester. Examination will be conducted along with 5<sup>th</sup> semester practical.</b>									

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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
	<b>Elective-I</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>40</b>	<b>60</b>	<b>100</b>	<b>4</b>
	<b>Elective-II</b>		<b>3</b>	<b>1</b>	<b>0</b>	<b>40</b>	<b>60</b>	<b>100</b>	<b>4</b>
	<b>Elective-I Laboratory</b>		<b>0</b>	<b>0</b>	<b>4</b>	<b>60</b>	<b>40</b>	<b>100</b>	<b>2</b>
	<b>Elective-II Laboratory</b>		<b>0</b>	<b>0</b>	<b>4</b>	<b>60</b>	<b>40</b>	<b>100</b>	<b>2</b>
	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
	<b>TOTAL</b>		<b>12</b>	<b>03</b>	<b>15</b>	<b>455</b>	<b>420</b>	<b>875</b>	<b>23</b>

<b>Elective -I</b>		<b>Elective -II</b>	
Course Code	Course Title	Course Code	Course Title
UGCA1931	Data Warehouse and Mining	UGCA1934	Computer Graphics
UGCA1932	Programming in Java	UGCA1935	Linux Operating System
UGCA1933	Internet of Things	UGCA1936	Cloud Computing

<b>Elective-I Laboratory</b>		<b>Elective-II Laboratory</b>	
Course Code	Course Title	Course Code	Course Title
UGCA1937	Data Warehouse and Mining Laboratory	UGCA1940	Computer Graphics Laboratory
UGCA1938	Programming in Java Laboratory	UGCA1941	Linux Operating System Laboratory
UGCA1939	Internet of Things 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
	<b>TOTAL</b>		<b>10</b>	<b>03</b>	<b>15</b>	<b>455</b>	<b>485</b>	<b>875</b>	<b>25</b>

Elective -III		Elective -IV	
Course Code	Course Title	Course Code	Course Title
UGCA1945	Artificial Intelligence	UGCA1948	Information Security
UGCA1946	R Programming	UGCA1949	Cyber Laws & IPR
UGCA1947	Digital Marketing	UGCA1950	Machine Learning

Elective -III		Elective -IV	
Course Code	Course Title	Course Code	Course Title
UGCA1951	Artificial Intelligence Laboratory	UGCA1954	Information Security Laboratory
UGCA1952	R Programming Laboratory	UGCA1955	Cyber Laws & IPR Laboratory
UGCA1953	Digital Marketing 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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 4</b>
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status: core/elective:</b> 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:

<b>CO#</b>	<b>Course Outcomes</b>
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.

<b>Detailed contents</b>	<b>Contact hours</b>
<p><b><u>Unit-I</u></b> 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.</p>	12 hours
<p><b><u>Unit-II</u></b> Logic Statement, Connectives, Basic Logic Operations (Conjunction, Disjunction, Negation) Logical Equivalence/Equivalent Statements, Tautologies and Contradictions.</p>	10 hours
<p><b><u>Unit -III</u></b> 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.</p>	12 hours

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<b>Unit-IV</b> Progressions Introduction, Arithmetic Progression, Sum of Finite number of quantities in A.P, Arithmetic Means, Geometric Progression, Geometric Mean.	10 hours
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**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](http://www.see.leeds.ac.uk/geo-maths/basic_maths.pdf)
2. [www.britannica.com/science/matrix-mathematics](http://www.britannica.com/science/matrix-mathematics)
3. [www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html](http://www.pdfdrive.com/schaums-outline-of-discrete-mathematics-third-edition-schaums-e6841453.html)

**Course Code: UGCA1902**

**Course Name: Fundamentals of Computer and IT**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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.

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**Bachelor of Computer Applications (BCA)**

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
<p><b>Unit-I</b></p> <p><b>Human Computer Interface</b>            Concepts of Hardware and Software; Data and Information.</p> <p><b>Functional Units of Computer System:</b> CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.</p> <p><b>Devices:</b> Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter.</p> <p><b>Memory:</b> Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.</p> <p><b>Data Representation:</b> Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.</p>	12
<p><b>Unit-II</b></p> <p><b>Concept of Computing, Types of Languages:</b> Machine, assembly and High level Language; Operating system as user interface, utility programs.</p> <p><b>Word processing:</b> Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.</p>	10
<p><b>Unit-III</b></p> <p><b>Spreadsheet:</b> Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts &amp; Graphs.</p> <p><b>Presentation Graphics Software:</b> Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.</p>	10

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<p><b>Unit-IV</b></p> <p><b>Electronic Payment System:</b> 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.</p> <p>Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)</p>	12
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**Text Books:**

1. Introduction to Information Technology, IITL 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](http://www.sakshat.ac.in)
2. <https://swayam.gov.in/course/4067-computer-fundamentals>

**Course Code: UGCA1903**

**Course Name: Problem Solving using C**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

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**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
<p><b>Unit-I</b></p> <p><b>Logic Development:</b> 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.</p> <p><b>Operations and Expressions:</b> Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.</p>	11
<p><b>Unit-II</b></p> <p><b>Data Input and Output:</b> formatted &amp; unformatted input output.</p> <p><b>Control Statements:</b> While, Do-while and For statements, Nested loops, If-else, Switch, Break – Continue statements.</p>	10
<p><b>Unit-III</b></p> <p><b>Functions:</b> Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion.</p> <p><b>Arrays:</b> Defining, processing arrays, passing arrays to a function, multi-dimensional arrays.</p> <p><b>Strings:</b> String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.</p>	11

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<p><b>Unit-IV</b></p> <p><b>Structures &amp; Unions:</b> Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions.</p> <p><b>Pointers:</b> Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays</p> <p><b>File Handling:</b> File Operations, Processing a Data File</p>	12
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**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.
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**Course Code: UGCA1904**

**Course Name: Workshop on Desktop Publishing**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester examinations (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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:

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CO#	Course outcomes
CO1	The students will gain professional skills of <i>Desk Top Publishing</i> 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 <i>Title Page</i> of a Magazine/Book.
2.	Prepare multiple designs for a <i>Flex</i> by using different Tools.
3.	Prepare <i>NSS Certificates</i> for appreciation using logos of University, College & NSS unit.
4.	Prepare 5 different Designing of <i>Business Cards</i> .
5.	Prepare <i>Envelops</i> displaying full address of the company by inserting graphical symbol/ logos of company.
6.	Design and Print <i>Invoices</i> for three companies.
7.	Prepare and print <i>News Letter Layouts</i> for any five activities of your college/ university.
8.	Prepare <i>Invitation Cards</i> for cultural meet held in your college.
9.	Design and print <i>Brochures</i> to advertise a “Blood Donation Camp” in your college.
10.	Design <i>Logos</i> 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.

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**Software Tools:**

1. Adobe Illustrator 14.
  2. CorelDraw Graphics Suit.
  3. GNU image manipulation program.
  4. Ink Scape.
  5. PhotoScape Setup.
  6. PM701.
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**Course Code: UGCA1905**

**Course Name: Problem Solving using C Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course Outcomes</b>
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.



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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

**Course Code: UGCA1906**

**Course Name: Fundamentals of Computer and IT Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

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**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: - NA-**

**Course Outcomes:**

CO#	Course outcomes
CO1	Familiarizing with Open Office (Word processing, Spreadsheets and Presentation).
CO2	To acquire knowledge on editor, spread sheet and presentation software.
CO3	The students will be able to perform documentation and accounting operations.
CO4	Students can learn how to perform presentation skills.

**Instructions:**

<b>Word Orientation:</b>	
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.
<b>Excel Orientation:</b>	
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

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	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
<b>Presentation Orientation:</b>	
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
<b>Internet and its Applications</b>	
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, IITL Education Solutions limited, Pearson Education.
3. Introduction to information technology, Turban, Rainer and Potter, John Wiley and Sons.
4. Problem Solving Cases in Microsoft Excel, Joseph Brady & Ellen F Monk, Thomson Learning.

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**AECC (For UGC courses)  
BTHU103-18 English:**

**Course Outcomes:**

- The objective of this course is to introduce students to the theory, fundamentals and tools of communication.
- To help the students become the independent users of English language.
- To develop in them vital communication skills which are integral to their personal, social and professional interactions.
- The syllabus shall address the issues relating to the Language of communication.
- Students will become proficient in professional communication such as interviews, group discussions, office environments, important reading skills as well as writing skills such as report writing, note taking etc.

The recommended readings given at the end are only suggestive; the students and teachers have the freedom to consult other materials on various units/topics given below. Similarly, the questions in the examination will be aimed towards assessing the skills learnt by the students rather than the textual content of the recommended books.

**Detailed Contents:**

**Unit1- 1 (Introduction)**

- Theory of Communication
- Types and modes of Communication

**Unit- 2 (Language of Communication)**

- Verbal and Non-verbal
- (Spoken and Written)
- Personal, Social and Business
- Barriers and Strategies
- Intra-personal, Inter-personal and Group communication

**Unit-3 (Reading and Understanding)**

- Close Reading
- Comprehension
- Summary Paraphrasing
- Analysis and Interpretation
- Translation(from Hindi/Punjabi to English and vice-versa)

**OR**

**Precis writing /Paraphrasing (for International Students)**

- Literary/Knowledge Texts

**Unit-4 (Writing Skills)**

- Documenting
- Report Writing
- Making notes

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- 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 Heasley. Cambridge University Press. 2006.
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**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

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**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

**Course Code: HVPE101-18**

**Course Name: Human Values, De-addiction and Traffic Rules**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 0 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 3
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 33 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Ability Enhancement

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
CO1	To help the students appreciate the essential complementarity 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.

<b>Detailed Contents</b>	<b>Contact hours</b>
<b>Unit-I</b>  <b>Course Introduction - Need, Basic Guidelines, Content and Process for Value Education</b>	8

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<ol style="list-style-type: none"> <li>1. Understanding the need, basic guidelines, content and process for Value Education</li> <li>2. Self-Exploration—what is it? - its content and process; ‘Natural Acceptance’ and Experiential Validation- as the mechanism for self-exploration</li> <li>3. Continuous Happiness and Prosperity- A look at basic Human Aspirations</li> <li>4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfillment of aspirations of every human being with their correct priority</li> <li>5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario</li> <li>6. Method to fulfill the above human aspirations: understanding and living in harmony at various levels</li> </ol>	
<p><b>Unit-II</b></p> <p><b>Understanding Harmony in the Human Being - Harmony in Myself!</b></p> <ol style="list-style-type: none"> <li>1. Understanding human being as a co-existence of the sentient ‘I’ and the material ‘Body’</li> <li>2. Understanding the needs of Self (‘I’) and ‘Body’ - <i>Sukh</i> and <i>Suvidha</i></li> <li>3. Understanding the Body as an instrument of ‘I’ (I being the doer, seer and enjoyer)</li> <li>4. Understanding the characteristics and activities of ‘I’ and harmony in ‘I’</li> <li>5. Understanding the harmony of I with the Body: <i>Sanyam</i> and <i>Swasthya</i>; correct appraisal of Physical needs, meaning of Prosperity in detail</li> <li>6. Programs to ensure <i>Sanyam</i> and <i>Swasthya</i>  - Practice Exercises and Case Studies will be taken up in Practice Sessions.</li> </ol>	8
<p><b>Unit-III</b></p> <p><b>Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship</b></p> <ol style="list-style-type: none"> <li>1. Understanding harmony in the Family- the basic unit of human interaction</li> <li>2. Understanding values in human-human relationship; meaning of <i>Nyaya</i> and program for its fulfillment to ensure <i>Ubhay-tripti</i>; Trust (<i>Vishwas</i>) and Respect (<i>Samman</i>) as the foundational values of relationship</li> <li>3. Understanding the meaning of <i>Vishwas</i>; Difference between intention and competence</li> <li>4. Understanding the meaning of <i>Samman</i>, Difference between respect and differentiation; the other salient values in relationship</li> </ol>	6

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<p>5. Understanding the harmony in the society (society being an extension of family): <i>Samadhan, Samridhi, Abhay, Sah-astitva</i> as comprehensive Human Goals</p> <p>6. Visualizing a universal harmonious order in society- Undivided Society (<i>Akhand Samaj</i>), Universal Order (<i>Sarvabhaum Vyawastha</i>)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.</p>	
<p><b>Unit-IV</b></p> <p><b>Understanding Harmony in the Nature and Existence - Whole existence as Co-existence</b></p> <p>1. Understanding the harmony in the Nature</p> <p>2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature</p> <p>3. Understanding Existence as Co-existence (<i>Sah-astitva</i>) of mutually interacting units in all-pervasive space</p> <p>4. Holistic perception of harmony at all levels of existence - Practice Exercises and Case Studies will be taken up in Practice Sessions.</p>	5
<p><b>Unit-V</b></p> <p><b>Implications of the above Holistic Understanding of Harmony on Professional Ethics</b></p> <p>1. Natural acceptance of human values</p> <p>2. Definitiveness of Ethical Human Conduct</p> <p>3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order</p> <p>4. Competence in professional ethics:</p> <p style="padding-left: 20px;">a) Ability to utilize the professional competence for augmenting universal human order,</p> <p style="padding-left: 20px;">b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,</p> <p style="padding-left: 20px;">c) Ability to identify and develop appropriate technologies and management patterns for above production systems.</p> <p>5. Case studies of typical holistic technologies, management models and production systems</p> <p>6. Strategy for transition from the present state to Universal Human Order:</p> <p style="padding-left: 20px;">a) At the level of individual: as socially and ecologically responsible engineers, technologists and managers</p> <p style="padding-left: 20px;">b) At the level of society: as mutually enriching institutions and organizations.</p>	6



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**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

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**Course Code: HVPE102-18**

**Course Name: Human Values, De-addiction and Traffic Rules (Lab/ Seminar)**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 1</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 1
<b>Semester:</b> 1 <sup>st</sup>	<b>Contact hours:</b> 1 hour per week
<b>Internal max. marks:</b> 25	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 0	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 25	<b>Elective status:</b> Ability Enhancement

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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.

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**Course Code: UGCA1907**

**Course Name: Fundamentals of Statistics**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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:

<b>CO#</b>	<b>Course Outcomes</b>
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.

<b>Detailed Contents</b>	<b>Contact hours</b>
<p><b>Unit I</b></p> <p>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</p> <p>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).</p>	8 hours

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<p><b>Unit II</b></p> <p>Classification of Data Frequency Distribution: Introduction Classification of Data, Objectives of Classification, Methods of Classification, Ways to Classify Numerical Data or Raw Data.</p> <p>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.</p>	12 hours
<p><b>Unit III</b></p> <p>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.</p>	12 hours
<p><b>Unit IV</b></p> <p>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.</p>	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.

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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.(1977), Statistical Concepts and Methods, New York, John Wiley & Sons.

**E-Books/ Online learning material**

1. [http://onlinestatbook.com/Online\\_Statistics\\_Education.pdf](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>

**Course Code: UGCA1908**

**Course Name: Computer System Architecture**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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
<b>Unit-I</b>  <b>Logic Gates:</b> AND, OR, NOT, NAND, NOR, XOR, XNOR, NAND & NOR as Universal Gates, Logic Gates Applications.  <b>Boolean Algebra:</b> Introduction, Theorems, Simplification of Boolean Expression using Boolean Algebra, SOP & POS Forms, Realization of	12

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Boolean Expression using Gates, K-Maps, Simplification of Boolean Expression using K-Maps.	
<p><b>Unit-II</b></p> <p><b>Combinational Logic Circuits:</b> Half Adder &amp; Half Subtractor, Full Adder &amp; Full Subtractor, Parallel Binary Adder, Binary Adder/Subtractor.</p> <p><b>Combinational Logic Circuits:</b> Multiplexers &amp; Demultiplexers, Implementation of Boolean equations using Multiplexer and Demultiplexer, Encoders &amp; Decoders.</p>	12
<p><b>Unit-III</b></p> <p><b>Sequential Logic Circuits:</b> 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.</p>	8
<p><b>Unit-IV</b></p> <p><b>Introduction to Computer Organization:</b> Introduction to Computer and CPU (Computer Organization, Computer Design and Computer Architecture), Stored Program Concept- Von Neumann Architecture, Harvard Architecture, RISC and CISC Architecture.</p> <p><b>Register Transfer and Micro operations-</b> Introduction to Registers, Instruction Format, Types of Instructions- Memory Reference Instructions, Register Reference Instructions and Input-Output Instructions.</p> <p><b>Common Bus System:</b> 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.</p>	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.

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5. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.

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**Course Code: UGCA1909**

**Course Name: Object Oriented Programming using C++**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 44 hours
<b>Internal max. marks:</b> 40	<b>Theory/Practical:</b> Theory
<b>External max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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
<p><b>Unit-I</b></p> <p><b>Principles of object oriented programming</b> 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</p>	12
<p><b>Unit-II</b></p> <p><b>Classes &amp; Objects and Concept of Constructors</b> 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.</p> <p>Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.</p>	10

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<p><b>Unit-III</b></p> <p><b>Inheritance and Operator overloading</b> 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</p>	12
<p><b>Unit-IV</b></p> <p><b>Polymorphism and File Handling</b> Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes.  Opening and Closing File, Reading and Writing a file.</p>	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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

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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 class 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.



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14.	Write a program to read and write from file.
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**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**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 4
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> 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.

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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:  <table style="margin-left: 40px; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">Class</td> <td style="padding: 0 10px;">156-158</td> <td style="padding: 0 10px;">158-160</td> <td style="padding: 0 10px;">160-162</td> <td style="padding: 0 10px;">162-164</td> <td style="padding: 0 10px;">164-166</td> </tr> <tr> <td style="padding: 0 10px;">Frequency</td> <td style="padding: 0 10px;">4</td> <td style="padding: 0 10px;">8</td> <td style="padding: 0 10px;">28</td> <td style="padding: 0 10px;">51</td> <td style="padding: 0 10px;">89</td> </tr> </table>	Class	156-158	158-160	160-162	162-164	164-166	Frequency	4	8	28	51	89		
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.  <table style="margin-left: 40px; border-collapse: collapse;"> <tr> <td style="padding: 0 10px;">IQ</td> <td style="padding: 0 10px;">75-84</td> <td style="padding: 0 10px;">85-94</td> <td style="padding: 0 10px;">95-104</td> <td style="padding: 0 10px;">105-114</td> <td style="padding: 0 10px;">115-124</td> <td style="padding: 0 10px;">125-134</td> </tr> <tr> <td style="padding: 0 10px;">No. of Children</td> <td style="padding: 0 10px;">8</td> <td style="padding: 0 10px;">20</td> <td style="padding: 0 10px;">45</td> <td style="padding: 0 10px;">54</td> <td style="padding: 0 10px;">28</td> <td style="padding: 0 10px;">16</td> </tr> </table>	IQ	75-84	85-94	95-104	105-114	115-124	125-134	No. of Children	8	20	45	54	28	16
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](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](http://college.cengage.com/mathematics/brase/understandable_statistics/9780618949922_ch03.pdf)
3. [http://www.rockcreekschools.org/pages/uploaded\\_files/Excel%201%20Lab%20Exercises.pdf](http://www.rockcreekschools.org/pages/uploaded_files/Excel%201%20Lab%20Exercises.pdf)

**Course Code: UGCA1912**

**Course Name: Computer System Architecture Laboratory**

<b>Program:</b> BCA	<b>L: 0    T: 0    P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 2 <sup>nd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 60	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

**Prerequisite:** Basic knowledge of Fundamentals of Computer and IT

**Co requisite:** -NA-

**Additional material required in ESE:** -NA-

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**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.

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5. Digital Fundamentals, Floyd, Ninth Edition, PHI.
  6. Digital Integrated Electronics, Taub & Schilling, Eighth Edition, Mc-Graw Hill.
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**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

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**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, Clarendon 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)

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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

**Course Code: UGCA1913**

**Course Name: Computer Networks**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Core
<b>Total marks:</b> 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
<b>Unit-I</b> <b>Data communications concepts:</b> Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex. <b>Types of Networks:</b> LAN, MAN, WAN  <b>Network Topologies:</b> Bus, Star, Ring, Mesh, Tree, Hybrid	12

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<p><b>Communication Channels: Wired transmissions:</b> Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission.</p> <p><b>Communication Switching Techniques:</b> Circuit Switching, Message Switching, Packet Switching.</p>	
<p><b>Unit-II</b></p> <p><b>Network Reference Models:</b> 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.</p> <p><b>Data Link Layer Design Issues:</b> Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)</p>	10
<p><b>Unit-III</b></p> <p><b>MAC sub layer:</b> CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring)</p> <p><b>Network Layer:</b> Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.</p>	12
<p><b>Unit-IV</b></p> <p><b>Transport Layer:</b> Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols.</p> <p><b>Session, Presentation and Application Layers:</b> 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.</p>	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.

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**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**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 40%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Core
<b>Total marks:</b> 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
<b>Unit-I</b>  <b>Introduction to Python Programming Language:</b> Programming Language, History and Origin of Python Language, Features of Python, Limitations, Major Applications of Python, Getting, Installing Python, Setting up Path and Environment Variables, Running Python, First Python Program, Python Interactive Help Feature, Python differences from other languages.	12



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<p><b>Python Data Types &amp; Input/Output:</b> Keywords, Identifiers, Python Statement, Indentation, Documentation, Variables, Multiple Assignment, Understanding Data Type, Data Type Conversion, Python Input and Output Functions, Import command.</p> <p><b>Operators and Expressions:</b> Operators in Python, Expressions, Precedence, Associativity of Operators, Non Associative Operators.</p>	
<p><b>Unit-II</b></p> <p><b>Control Structures:</b> Decision making statements, Python loops, Python control statements.</p> <p><b>Python Native Data Types:</b> Numbers, Lists, Tuples, Sets, Dictionary, Functions &amp; Methods of Dictionary, Strings (in detail with their methods and operations).</p>	10
<p><b>Unit-III</b></p> <p><b>Python Functions:</b> 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.</p> <p><b>Python Modules:</b> Module definition, Need of modules, Creating a module, Importing module, Path Searching of a Module, Module Reloading, Standard Modules, Python Packages.</p>	12
<p><b>Unit-IV</b></p> <p><b>Exception Handling:</b> Exceptions, Built-in exceptions, Exception handling, User defined exceptions in Python.</p> <p><b>File Management in Python:</b> Operations on files (opening, modes, attributes, encoding, closing), read() &amp; write() methods, tell() &amp; seek() methods, renaming &amp; deleting files in Python, directories in Python.</p> <p><b>Classes and Objects:</b> The concept of OOPS in Python, Designing classes, Creating objects, Accessing attributes, Editing class attributes, Built-in class attributes, Garbage collection, Destroying objects.</p>	10

**Text Books:**

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2<sup>nd</sup> Edition, Dreamtech.

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**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**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Core
<b>Total marks:</b> 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
<p><b>Unit-I</b></p> <p><b>Introduction to Data Structures:</b> 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.</p> <p><b>Arrays, Pointers and Strings:</b> Introduction to Arrays, Definition, One Dimensional Array and Multi-Dimensional Arrays, Pointer, Pointer to Structure, various Programs for Array</p>	10

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and Pointer. Strings. Introduction to Strings, Definition, Library Functions of Strings.	
<p><b>Unit-II</b></p> <p><b>Stacks and Queue</b> 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.</p>	8
<p><b>Unit-III</b></p> <p><b>Linked Lists and Trees</b> Introduction, Representation and Operations of Linked Lists, Singly Linked List, Doubly Linked List, Circular Linked List, And Circular Doubly Linked List.</p> <p><b>Trees</b> 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.</p>	14
<p><b>Unit-IV</b></p> <p><b>Graphs, Searching, Sorting and Hashing</b> <b>Graphs:</b> Introduction, Representation to Graphs, Graph Traversals Shortest Path Algorithms.</p> <p><b>Searching and Sorting:</b> Searching, Types of Searching, Sorting, Types of sorting like quick sort, bubble sort, merge sort, selection sort.</p> <p><b>Hashing:</b> Hash Function, Types of Hash Functions, Collision, Collision Resolution Technique (CRT), Perfect Hashing</p>	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., Ullman Jeffrey D., “Data Structures and Algorithms”, AddisonWesley

**Reference books**

1. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

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2. Yashwant Kanetkar, Understanding Pointers in C, BPB Publications.
  3. Horowitz, S. Sahni, and S. Rajasekaran, Computer Algorithms, Galgotia Pub. Pvt. Ltd., 1998.
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**Course Code: UGCA1916**

**Course Name: Computer Networks Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

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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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P:4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 90%
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective Status :</b> Core
<b>Total marks:</b> 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 :

<b>CO#</b>	<b>Course outcomes</b>
CO1	Solve simple to advanced problems using Python language.
CO2	Develop logic of various programming problems using numerous data types and control structures of Python.
CO3	Implement different data structures.
CO4	Implement modules and functions.
CO5	Design and implement the concept of object oriented programming structures.
CO6	Implement file handling.

**List of assignments:**

1.	Compute sum, subtraction, multiplication, division and exponent of given variables input by the user.
2.	Compute area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute volume of following 3D shapes: cube, cylinder, cone and sphere.

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4.	Compute and print roots of quadratic equation $ax^2+bx+c=0$ , where the values of a, b, and c are input by the user.
5.	Print numbers up to N which are not divisible by 3, 6, 9,, e.g., 1, 2, 4, 5, 7,....
6.	Write a program to determine whether a triangle is isosceles or not?
7.	Print multiplication table of a number input by the user.
8.	Compute sum of natural numbers from one to n number.
9.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13.....n
10.	Compute factorial of a given number.
11.	Count occurrence of a digit 5 in a given integer number input by the user.
12.	Print Geometric and Harmonic means of a series input by the user.
13.	Evaluate the following expressions: a. $x-x^2/2!+x^3/3!- x^4/4!+... x^n/n!$ b. $x-x^3/3!+x^5/5!- x^7/7!+... x^n/n!$
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 <i>Rectangle</i> , constructed by a length & width, also design a method which will compute the area of a rectangle.
36.	Design a Python class named <i>Circle</i> 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'.

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38.	Write a Python program to read an entire <i>text file</i> .
39.	Design a Python program to read first n lines of a <i>text file</i> .
40.	Construct a Python program to write and append text to a file and display the text.

**Text Books:**

1. Programming in Python, Pooja Sharma, BPB Publications, 2017.
2. Core Python Programming, R. Nageswara Rao, 2<sup>nd</sup> 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: UGCA1918**

**Course Name: Data Structures Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 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

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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., Ullman Jeffrey D., "Data Structures and Algorithms", AddisonWesley
3. Horowitz & Sawhaney: Fundamentals of Data Structures, Galgotia Publishers.

**Course Code: UGCA1919**

**Course Name: PC Assembly & Troubleshooting**

<b>Program:</b> BCA	<b>L:3T:0 P:0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 3
<b>Semester :</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 33 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 80%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs



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<b>External max. marks:</b> 60	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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
<p><b>Unit I:</b></p> <p>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.</p>	9
<p><b>Unit II:</b></p> <p>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.</p>	8
<p><b>Unit III:</b></p> <p>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.</p>	8
<p><b>Unit IV:</b></p> <p>Diagnose and troubleshooting of microcomputer/ computer systems hardware &amp; 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.</p>	8

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**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.
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**Course Code: UGCA1920**

**Course Name: PC Assembly & Troubleshooting Laboratory**

<b>Program:</b> BCA	<b>L:0 T:0 P:2</b>
<b>Branch:</b> Computer Application	<b>Credits:</b> 1
<b>Semester:</b> 3 <sup>rd</sup>	<b>Contact hours:</b> 2 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 95%
<b>Internal max. marks:</b> 30	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 20	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 50	

**Prerequisite:** -NA-

**Co requisite:** -NA-

**Additional material required in ESE:** -NA-

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

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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

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:-</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE): -</b>
<b>External max. marks:</b> 60	<b>Core/Elective status:</b> core
<b>Total marks:</b> 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 the computing 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.

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<b>Detailed contents</b>	<b>Contact hours</b>
<b>Unit 1</b>  The Nature of Software, Need of Software Engineering, Prescriptive Process Models, Specialized Process Models, The Unified Process.	10
<b>Unit 2</b>  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
<b>Unit 3</b>  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
<b>Unit 4</b>  Testing Fundamentals, Unit Testing, Integration Testing, Validation Testing, System Testing, Maintenance and Reengineering, Measures, Metrics, and Indicators, Software Measurement, Metrics for Requirements Model, Metrics for Design Model, Metrics for Testing, Metrics for Maintenance.	12

**Text Books:**

1. Software Engineering–A Practitioner’s Approach, Roger S.Pressman, Seventh Edition, McGrawHill, 2010.

**Reference Books:**

1. An Integrated Approach to Software Engineering, Pankaj Jalota, Third Edition, Narosa Publishing House, 2005
  2. Software Engineering, Ian Sommerville, Ninth Edition, Addison-Wesley, 2011
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**Course Code: UGCA1922**

**Course Name: Database Management Systems**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 4</b>
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Core
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:** Students will be able to

<b>CO#</b>	<b>Course outcomes</b>
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.

<b>Detailed contents</b>	<b>Contact hours</b>
<p><b>Unit-I</b></p> <p>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.</p>	10
<p><b>Unit-II</b></p> <p>Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.</p>	12
<p><b>Unit-III</b></p> <p>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).</p>	12

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<b>Unit-IV</b>	
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**

<b>Program:</b> BCA	<b>L: 3    T: 1    P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 15%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Core
<b>Total marks:</b> 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.

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Detailed contents	Contact hours
<p><b>Unit-I</b></p> <p><b>Fundamentals of Operating system:</b> 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.</p> <p><b>Process &amp; Thread Management:</b> Program vs. Process; PCB, State transition diagram, Scheduling Queues, Types of schedulers, Concept of Thread, Benefits, Types of threads, Process synchronization.</p> <p><b>CPU Scheduling:</b> Need of CPU scheduling, CPU I/O Burst Cycle, Pre-emptive vs. Non-pre-emptive scheduling, Different scheduling criteria's, scheduling algorithms (FCFS, SJF, Round-Robin, Multilevel Queue).</p>	12
<p><b>Unit-II</b></p> <p><b>Memory Management:</b> Introduction, address binding, relocation, loading, linking, memory sharing and protection; Paging and segmentation; Virtual memory: basic concepts of demand paging, page replacement algorithms.</p>	12
<p><b>Unit-III</b></p> <p><b>I/O Device Management:</b> I/O devices and controllers, device drivers; disk storage.</p> <p><b>File Management:</b> Basic concepts, file operations, access methods, directory structures and management, remote file systems; file protection.</p>	08
<p><b>Unit-IV</b></p> <p><b>Advanced Operating systems:</b> Introduction to Distributed Operating system, Characteristics, architecture, Issues, Communication &amp; Synchronization; Introduction Multiprocessor Operating system, Architecture, Structure, Synchronization &amp; Scheduling; Introduction to Real-Time Operating System, Characteristics, Structure &amp; Scheduling. Case study of Linux operating system</p>	12

**Text Books:**

1. Operating System Principles by Abraham Silberschatz and Peter Baer Galvin, Seventh Edition, Published by Wiley-India.

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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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:** Students will be able to

<b>CO#</b>	<b>Course outcomes</b>
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: <i>a. College automation system.</i> <i>b. Banking Management System.</i>
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



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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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 100%
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
CO1	Able to understand various queries and their execution
CO2	Populate and query a database using SQL DML/DDI commands.
CO3	Declare and enforce integrity constraints on a database
CO4	Programming PL/SQL including stored procedures, stored functions, cursors, packages
CO5	Able to design new database and modify existing ones for new applications and reason about the efficiency of the result

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**Instructions:**

1.	Used of CREATE, ALTER, RENAME and DROP statement in the database tables (relations)
2.	Used of INSERT INTO, DELETE and UPDATE statement in the database tables (relations)
3.	Use of simple select statement.
4.	Use of select query on two relations
5.	Use of nesting of queries.
6.	Use of aggregate functions.
7.	Use of substring comparison.
8.	Use of order by statement.
9.	<p>Consider the following schema for a Library Database:</p> <p>BOOK (<i>Book_id, Title, Publisher_Name, Pub_Year</i>)</p> <p>BOOK_AUTHORS (<i>Book_id, Author_Name</i>)</p> <p>PUBLISHER (<i>Name, Address, Phone</i>)</p> <p>BOOK_COPIES (<i>Book_id, Branch_id, No-of_Copies</i>)</p> <p>BOOK_LENDING (<i>Book_id, Branch_id, Card_No, Date_Out, Due_Date</i>)</p> <p>LIBRARY_BRANCH (<i>Branch_id, Branch_Name, Address</i>)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Retrieve details of all books in the library_id, title, name of publisher, authors, number of copies in each branch, etc.</li> <li>2. Get the particulars of borrowers who have borrowed more than 3 books between Jan 2018 to Jun 2018</li> <li>3. Delete a book in BOOK table. Update the contents of other tables to reflect this data manipulation operation.</li> <li>4. Partition the BOOK table based on year of publication. Demonstrate its working with a simple query.</li> <li>5. Create a view of all books and its number of copies that are currently available in the Library.</li> </ol>
10.	<p>Consider the following schema for Order Database:</p> <p>SALESMAN (<i>Salesman_id, Name, City, Commission</i>)</p> <p>CUSTOMER (<i>Customer_id, Cust_Name, City, Grade, Salesman_id</i>)</p> <p>ORDERS (<i>Ord_No, Purchase_Amt, Ord_Date, Customer_id, Salesman_id</i>)</p> <p>Write SQL queries to</p> <ol style="list-style-type: none"> <li>1. Count the customers with grades above Amritsar's average.</li> <li>2. Find the name and numbers of all salesmen who had more than one customer.</li> <li>3. List all salesmen and indicate those who have and don't have customers in their cities (Use UNION operation.)</li> <li>4. Create a view that finds the salesman who has the customer with the highest order of a day.</li> <li>5. Demonstrate the DELETE operation by removing salesman with id 1000. All his orders must also be deleted.</li> </ol>
11.	Write a PL/SQL code to add two numbers and display the result. Read the numbers during run time.

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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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 100
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 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

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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**

<b>Program:</b> BCA	<b>L: 3 T: 0 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 3
<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 33 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 80%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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.

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Detailed Contents	Contact hours
<p><b>Unit-I</b></p> <p><b>Internet Basics</b> Basic concepts, communicating on the internet, internet domains, internet server identities, establishing connectivity on the internet client IP address.</p> <p><b>Introduction To HTML</b> 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.</p>	8
<p><b>Unit-II</b></p> <p><b>Lists</b> Type of Lists (Unordered List (Bullets), Ordered Lists (Numbering), Definition Lists.</p> <p><b>Adding Graphics To Html Documents</b> Using The Border Attribute, Using The Width And Height Attribute, Using The Align Attribute, Using The Alt Attribute.</p> <p><b>Tables</b> 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</p> <p><b>Linking Documents</b> Links (External Document References, Internal Document References), Image As Hyperlinks.</p> <p><b>Frames</b> Introduction to Frames: The&lt;FRAMESET&gt; tag, The &lt;FRAME&gt; tag, Targeting Named Frames. DHTML: Cascading Style Sheets, Style Tag.</p>	9
<p><b>Unit-III</b></p> <p><b>Forms Used by a Web Site</b> The Form Object, The Form Object's Methods (The Text Element, The Password Element, The Button Element, The Submit (Button) Element, The Reset (Button)</p>	8

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Element, The Checkbox Element, The Radio Element, The Text Area Element, The Select and Option Element, The Multi Choice Select Lists Element).	
<b>Unit 4</b> <b>Introduction to JavaScript</b>  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](http://www.Ncsa.Nine.Edit/General/Internet/www/Html.Prmter)
4. [https://www.tutorialspoint.com/html/html\\_tutorial.pdf](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](https://www.cs.uct.ac.za/mit_notes/web_programming.html)
8. [http://www.pagetutor.com/table\\_tutor/index.html](http://www.pagetutor.com/table_tutor/index.html)

**Course Code: UGCA1928**

**Course Name: Web Designing Laboratory**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 2
<b>Branch:</b> Computer Applications	<b>Credits:</b> 1

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<b>Semester:</b> 4 <sup>th</sup>	<b>Contact hours:</b> 2 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 80%
<b>Internal max. marks:</b> 30	<b>Duration of End Semester Exam (ESE):</b> 3hrs
<b>External max. marks:</b> 20	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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.

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15.	Write an HTML code to create your Institute website/Department website/ Tutorial website for specific subject. Also use Java Script for validation.
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**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](https://www.w3schools.com/html/html_examples.asp)
2. [https://www.cs.uct.ac.za/mit\\_notes/web\\_programming.html](https://www.cs.uct.ac.za/mit_notes/web_programming.html)

**Course Code: UGCA1929**

**Course Name: Programming in PHP**

<b>Program:</b> BCA	<b>L: 3 T: 0 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 3</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 33 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 80%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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.



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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
<p><b>Unit-I</b></p> <p><b>Introduction to PHP</b> Evolution of PHP &amp; 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.</p> <p><b>Displaying type information:</b> Testing for a specific data type, Changing type with Set type, Operators, Variable manipulation, Dynamic variables and Variable scope.</p>	11
<p><b>Unit-II</b></p> <p><b>Control Statements</b> if() and elseif() condition Statement, The switch statement, Using the? Operator, Using the while() Loop, The do while statement, Using the for() Loop.</p> <p><b>Functions</b> Function definition, Creation, Returning values, Library Functions, User-defined functions, Dynamic function, default arguments, Passing arguments to a function by value.</p> <p><b>String Manipulation</b> Formatting String for Presentation, Formatting String for Storage, Joining and Splitting String, Comparing String</p> <p><b>Array</b> Anatomy of an Array, Creating index based and Associative array, Looping array using each() and foreach() loop.</p>	10
<p><b>Unit-III</b></p> <p><b>Forms</b> 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.</p>	10

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<p><b>Working with File and Directories</b> Understanding file &amp; directory, Opening and closing a file, Coping, renaming and deleting a file, Working with directories, File Uploading &amp; Downloading. Generating Images with PHP: Basics computer Graphics, Creating Image.</p>	
<p><b>Unit-IV</b>  <b>Database Connectivity with MySql</b> Introduction to RDBMS, Connection with MySql Database, Performing basic database operation (DML) (Insert, Delete, Update, Select).</p>	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](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>

**Course Code: UGCA1930**

**Course Name: Programming in PHP Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 2</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 1
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 2 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 80%
<b>Internal max. marks:</b> 30	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 20	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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.

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**Additional material required in ESE:**

- Demonstration of the website of college/ specific department/specific cells etc. will be presented by the students during the final practical.
- Developed Website/s must be made online by the student/s.
- Printouts of the Main Page of the website must be arranged on Practical file during daily lab work and must be submitted in the final examinations.

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

CO#	Course outcomes
CO1	Solve simple to advanced online problems of Web Pages.
CO2	Develop logics of various programming problems using numerous data types and control structures.
CO4	Client Server concepts, Static & Dynamic environment of the websites etc.
CO5	Design and implement the concept of Database connectivity.
CO6	Front-End & Back-End concept of Database System.

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

1.	Take values from the user and compute sum, subtraction, multiplication, division and exponent of value of the variables.
2.	Write a program to find area of following shapes: circle, rectangle, triangle, square, trapezoid and parallelogram.
3.	Compute and print roots of quadratic equation.
4.	Write a program to determine whether a triangle is isosceles or not?
5.	Print multiplication table of a number input by the user.
6.	Calculate sum of natural numbers from one to n number.
7.	Print Fibonacci series up to n numbers e.g. 0 1 1 2 3 5 8 13 21.....n
8.	Write a program to find the factorial of any number.
9.	Determine prime numbers within a specific range.
10.	Write a program to compute, the Average and Grade of students marks.
11.	Compute addition, subtraction and multiplication of a matrix.
12.	Count total number of vowels in a word “Develop & Empower Individuals”.
13.	Determine whether a string is palindrome or not?
14.	Display word after Sorting in alphabetical order.
15.	Check whether a number is in a given range using functions.
16.	Write a program accepts a string and calculates number of upper case letters and lower case letters available in that string.
17.	Design a program to reverse a string word by word.
18.	Write a program to create a login form. On submitting the form, the user should navigate to profile page.
19.	Design front page of a college or department using graphics method.
20.	Write a program to upload and download files.

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**Reference Books:**

1. [PHP: The Complete Reference, “Steven Holzner”, January 1, 2007. Tata McGraw-Hill Education.](#)
2. [Programming PHP, “Kevin Tetroi”, O' Reilly.](#)
3. [Published by Wiley Publishing, Inc. 10475 Crosspoint Boulevard Indianapolis, IN 46256](#)

**E-Books/ Online learning material:**

1. <http://cs.petrus.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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 4</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 20%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<b>Unit-I</b> 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

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<b>Unit-II</b>	
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
<b>Unit-III</b>	
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
<b>Unit-IV</b>	
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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 90
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

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**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, 3<sup>rd</sup> edition by Ian H. Witten, Eibe Frank, Mark A. Hall Published by Morgan Kaufmann.
2. Data analytics using R, 1<sup>st</sup> 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>

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**Course Code:** UGCA1932

**Course Name:** Programming in Java

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4

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<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 40%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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

<b>CO#</b>	<b>Course outcomes</b>
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.

<b>Detailed Contents</b>	<b>Contact hours</b>
<p><b>Unit-I</b></p> <p><b>Java Programming Fundamentals:</b> Introduction to Java, Stage for Java, Origin, Challenges of Java, Java Features, Java Program Development, Object Oriented Programming.</p> <p><b>Java Essentials:</b> Elements of Java Program, Java API, Variables and Literals, Primitive Data Types, The String class, Variables, Constants, Operators, Scope of Variables &amp; Blocks, Types of Comment in Java.</p>	10
<p><b>Unit-II</b></p> <p><b>Control Statements:</b> 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).</p>	12

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<p><b>Classes and Objects:</b> Basic concepts of OOPS, Classes and Objects, Modifiers, Passing arguments, Constructors, Overloaded Constructors, Overloaded Operators, Static Class Members, Garbage Collection.</p> <p><b>Inheritance:</b> Basics of inheritance, Inheriting and Overriding Superclass methods, Calling Superclass Constructor, Polymorphism, Abstract Classes, Final Class.</p>	
<p><b>Unit-III</b></p> <p><b>Arrays and Strings:</b> 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.</p> <p><b>Interface and Packages:</b> Basics of interface, Multiple Interfaces, Multiple Inheritance Using Interface, Multilevel Interface, Packages, Create and Access Packages, Static Import and Package Class, Access Specifiers.</p> <p><b>Exception Handling:</b> Introduction, Try and Catch Blocks, Multiple Catch, Nested Try, Finally, Throw Statement, Built-In Exceptions.</p>	10
<p><b>Unit-IV</b></p> <p><b>Multithreading:</b> Introduction, Threads in Java, Thread Creation, Lifecycle of Thread, Joining a Thread, Thread Scheduler, Thread Priority, Thread Synchronization.</p> <p><b>Applets:</b> Introduction, Applet Class, Applet Life Cycle, Graphics in Applet, Event-Handling.</p> <p><b>File and I/O Streams:</b> File Class, Streams, Byte Streams, Filtered Byte Streams, Random Access File Class, Character Streams.</p>	12

**Text Books:**

1. Programming with Java A Primer, 5<sup>th</sup> 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, 7<sup>th</sup> Edition, TMH.



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**Course Code: UGCA1938**

**Course Name: Programming in Java Laboratory**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 4
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 90%
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Core
<b>Total marks:</b> 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

<b>CO#</b>	<b>Course Outcomes</b>
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) Circle 2) 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.

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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 <i>Multithreading</i> 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 <i>Multiple Inheritance</i> 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, 5<sup>th</sup> 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.

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**Reference Books:**

1. Java, The complete Reference, H. Schildt, 7<sup>th</sup> Edition, TMH.
2. Data Analytics using R, Seema Acharya, TMH.

**Course Code: UGCA1933**

**Course Name: Internet of Things**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

<b>Detailed Contents</b>	<b>Contact hours</b>
<p><b>Unit-I</b></p> <p>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.</p>	11
<p><b>Unit-II</b></p> <p>Domain Specific IoTs – Home, City, Environment, Energy, Retail, Logistics, Agriculture, Industry, health and Lifestyle.</p> <p>M2M Applications, Software Defined Networks, Network Function Virtualization.</p>	11

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<b>Unit-III</b>  Need for IoT System Management, Simple Network Management Protocol, Network Operator Requirements, NETCONF, YANG, IoT System Management with NETCOZF-YANG, IoT Design Methodology.	11
<b>Unit-IV</b>  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 Madiseti, 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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours a week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

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**Course Outcomes:**

CO#	Course outcomes
CO1	Understand the concepts of Internet of Things
CO2	Understand and analyzing sensor generated data
CO3	To Implement Data and Knowledge Management and use of Devices in IoT Technology.
CO4	Build small IoT applications

**Instructions:**

1	Interfacing Light Emitting Diode (LED) for Blinking LED
2	Interfacing Button and LED for LED blinking when button is pressed
3	Interfacing Light Dependent Resistor (LDR) and LED for displaying automatic night lamp
4	Interfacing Temperature Sensor (LM35) and/or humidity sensor (e.g. DHT11)
5	Interfacing Liquid Crystal Display (LCD) to display data generated by sensor on LCD
6	Interfacing Air Quality Sensor-pollution (e.g. MQ135) to display data on LCD , switch on LED when data sensed is higher than specified value.
7	Interfacing Bluetooth module (e.g. HC05) for receiving data from mobile phone on Arduino and display on LCD
8	Interfacing Relay module to demonstrate Bluetooth based home automation application. (using Bluetooth and relay).

**Reference Books:**

1. Internet of Things – A Hands-on Approach, Arshdeep Bahga and Vijay Madiseti, 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

**Course Code: UGCA1934**

**Course Name: Computer Graphics**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 4</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours: 44 hours</b>

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<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<p><b>Unit-I</b></p> <p><b>Introduction to Computer Graphics</b> Applications of Computer Graphics. Graphs and Types of Graphs</p> <p><b>Input Devices:</b> Light Pens, Graphic Tablets, Joysticks, Track Ball, Data Glove, Digitizers, Image Scanner.</p> <p><b>Video Display Devices:</b> 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.</p> <p><b>Introduction Virtual Reality &amp; Environments:</b> Applications in Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.</p>	11
<p><b>Unit-II</b></p> <p><b>Scan-conversions</b> Process and need of Scan Conversion, Scan conversion algorithms for Line, Circle and Ellipse using direct method, Bresenham's algorithms for line &amp; circle and Midpoint Ellipse Algorithm along with their derivations, Area Filling Techniques, Flood Fill Techniques, Character Generation.</p>	11
<p><b>Unit-III</b></p>	10

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<p><b>2 – Dimensional Graphics</b> 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.</p>	
<p><b>Unit-IV</b>  <b>3 – Dimensional Graphics</b> Introduction to 3-dimensional Graphics: Geometric Transformations (Translation, Scaling, Rotation), Mathematics of Projections (Parallel &amp; Perspective). Color Shading. Introduction to Morphing techniques.</p>	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](http://www.sakshat.ac.in)
2. <https://swayam.gov.in>

**Course Code: UGCA1940**

**Course Name: Computer Graphics Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

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CO4	Practical applications of graphics, Program development and basic animations without using graphical software.
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**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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 60%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite:** Operating System

**Co requisite:** -NA-

**Additional material required in ESE:** -NA-



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**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
<p><b>Unit-I</b></p> <p><b>Introduction to Linux</b>            History of Linux &amp; 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.</p>	12
<p><b>Unit-II</b></p> <p><b>Shells and Utilities</b>            Role of shells in the Linux environment, Different types of shells in Linux Operating system, Shell configuration: Shell initialization &amp; configuration directories &amp; file, Aliases, Filename expansion, Standard Input/ Output &amp; Redirection, Pipes, Managing Jobs.</p> <p><b>Shell Scripting:</b> 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.</p>	12
<p><b>Unit-III</b></p> <p><b>Files Systems &amp; Linux Software</b>            Linux Files, File structure, commands for managing files &amp; directories with other commonly used commands, Software Management, Office and Database Applications, Graphics Tools and Multimedia, Internet &amp; Network services, Web, FTP &amp; java Clients.</p>	10
<p><b>Unit-IV</b></p> <p><b>Linux Administration</b>            Managing users, Superuser Control, System Run levels, Managing File Systems,</p>	10

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<b>Kernel Administration:</b> Linux kernel sources, rebuilding kernel, installing kernel, Virtualization, backup management.	
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**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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> 100
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 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

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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**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 2
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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.

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Detailed contents	Contact hours
<p><b>Unit-I</b></p> <p><b>Overview of Computing Paradigm:</b> Recent trends in Computing -Grid Computing, Cluster Computing, Distributed Computing, Utility Computing, Cloud Computing.</p> <p><b>Introduction to Cloud Computing:</b> 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.</p> <p><b>Migrating into a Cloud:</b> Introduction, Broad approaches to Migrating into the Cloud, The Seven-Step Model of Migration Into a Cloud.</p>	12
<p><b>Unit-II</b></p> <p><b>Virtualization:</b> 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.</p> <p><b>Capacity Planning:</b> Elasticity vs Scalability, Introduction, Defining Baseline and Metrics-Baseline Measurements, System Metrics, Load Testing, Resource Ceilings, Server and Instance types; Network Capacity, Scaling.</p>	12
<p><b>Unit-III</b></p> <p><b>SLA Management in Cloud Computing:</b> Inspiration, Traditional Approaches to SLO Management, Types of SLA, Life Cycle of SLA, SLA management in Cloud. Automated Policy-based management.</p> <p><b>Securing Cloud services:</b> Cloud Security, Securing Data- Brokered Cloud Storage Access, Storage location and tenancy, Encryption, Auditing and compliance. Steps to ensure security over cloud.</p>	10
<p><b>Unit-IV</b></p> <p><b>Cloud Platforms in Industry:</b> 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.</p>	10

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**Text Books:**

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. 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.

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**Course Code: UGCA1942**

**Course Name: Cloud Computing Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 5 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite:** Working Knowledge of Linux Operating system

**Co requisite:** -NA-

**Additional material required in ESE:** -NA-

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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.

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**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**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 0 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 3
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 33 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Skill Enhancement
<b>Total marks:</b> 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.

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Detailed contents	Contact hours
<b>Unit-I</b> 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
<b>Unit-II</b> Integrating cloud services, networking, OS and hardware into mobile-applications. Enterprise requirements in mobile applications: Performance, Scalability, Modifiability, Availability and Security.	7
<b>Unit-III</b> Mobile Software Engineering (Design Principles, Development, Testing methodologies for mobile applications.	7
<b>Unit-IV</b> 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/>
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**Course Code: UGCA1944**

**Course Name: Android Programming Laboratory**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 2
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 2 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:--</b>
<b>Internal max. marks:</b> 30	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 20	<b>Elective status:</b> Skill Enhancement Laboratory
<b>Total marks:</b> 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



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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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<b>Unit-I</b>	10

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<p><b>Introduction</b>-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.</p> <p><b>Knowledge Representation:</b> 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.</p>	
<p><b>Unit-II</b></p> <p><b>Uncertain Knowledge and Reasoning:</b> Basic probability, Bayes rule, Belief networks, Default reasoning, Fuzzy sets and fuzzy logic.</p> <p><b>Structured Knowledge:</b> Associative Networks, Frame Structures, Conceptual Dependencies and Scripts.</p>	<b>10</b>
<p><b>Unit-III</b></p> <p><b>Uninformed Search strategies-</b> Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Comparing uninformed search strategies.</p> <p><b>Informed (Heuristic) Search Strategies-</b> Hill Climbing, Simulated Annealing, Genetic Algorithm, Greedy best-first search, A* and optimal search, Memory-bounded heuristic search.</p>	<b>12</b>
<p><b>Unit-IV</b></p> <p><b>Natural language processing:</b> Grammars, Parsing.</p> <p><b>Pattern Recognition:</b> Recognition and Classification Process-Decision Theoretic Classification, Syntactic Classification; Learning Classification Patterns, Recognizing and Understanding Speech.</p> <p><b>Expert System Architectures:</b> Characteristics, Rule-Based System Architectures, Nonproduction System Architectures, Knowledge Acquisition and Validation.</p>	<b>12</b>

**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.

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4. Artificial Intelligence 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**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 4
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 weeks per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 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.

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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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact Hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 40%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite:** Logics of basic programming terminologies.

**Co requisite:** Simulation study.

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course Outcomes</b>
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.

<b>Detailed Contents</b>	<b>Contact hours</b>
<b>Unit-I</b>	11

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<p><b>R Programming Fundamentals:</b> 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.</p> <p><b>Vectors:</b> Scalars, Vectors, Arrays and Matrices, Declarations, Recycling, Common Vector Operations, Using all() and any(), Na and Null Values, Filtering, ifelse() Function.</p> <p><b>Matrices and Arrays:</b> Creating Matrices, General Matrix Operations, Applying Functions to Matrix Rows and Columns, Adding &amp; Deleting Matrix Rows and Columns, Difference Between Matrix and Vector.</p>	
<p><b>Unit-II</b></p> <p><b>Lists:</b> Creating Lists, General List Operations, Accessing List Components and Values, Applying Functions to Lists, Recursive Lists.</p> <p><b>Data Frames:</b> Creating Data Frames, Merging Data Frames, Applying Functions to Data Frames.</p> <p><b>Factors and Tables:</b> Introduction, Common Functions use with Factors, Working with Tables.</p> <p><b>R Programming Structures:</b> Control Statements, Arithmetic and Boolean Operators, Default Values for Arguments, Return Values, Recursion.</p>	11
<p><b>Unit-III</b></p> <p><b>Object Oriented Programming:</b> Concept of Classes, S3 Classes, S4 Classes, S3 Versus S4 Classes, Managing Objects.</p> <p><b>Input/Output:</b> Accessing Keyboard and Monitor, Reading and Writing Files, Accessing the Internet.</p> <p><b>String Manipulation:</b> Overview of String Manipulation Functions [grep(), nchar(), paste(), sprintf(), substr(), strsplit(), regexpr(), gregexpr(), Regular expression].</p>	12
<p><b>Unit-IV</b></p> <p><b>Graphics:</b> Creating Graphs, Customizing Graphs, Saving Graphs to Files, Creating 3D Plots.</p> <p><b>Debugging:</b> Principles of Debugging, Use of Debugging Tool, Using R Programming Debugging Facilities.</p> <p><b>Simulation:</b> Generating Random Numbers, Setting the Random Number Seed, Simulating a Linear Model, Random Sampling.</p>	10

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**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**

<b>Program:</b> BCA	<b>L: 0 T: 0 P:4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 60	<b>Duration of End Semester Exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective Status:</b> Elective
<b>Total marks:</b> 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 using R programming..

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8.	Design a R program to find the factors of a given number.
9.	Write a R program to find the maximum and the minimum value of a given vector.
10.	Write a program to get the unique elements of a given string and unique numbers of vector.
11.	Convert a given matrix to a 1 dimensional array through R programming.
12.	Write a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors.
13.	Create a 3 dimensional array of 24 elements using dim() function.
14.	Write a R program to create an array using four given columns, three given rows and two given tables, also display the contents of the array.
15.	To convert a given matrix to 1 dimensional array design a R program.
16.	Write a R program to concatenate two given factor in a single factor.
17.	Write a R program to create an 3 dimensional array of 24 elements using the dim() function.
18.	Construct a R program to create an array of two 3x3 matrices each with 3 rows and 3 columns from the given two vectors. Print the second row of the second matrix of the array and the element in the 3rd row and 3rd column of the 1st matrix.
19.	Write a R program to create a data frame from four given vectors.
20.	Write a program to get the structure of a given data frame.
21.	Design a R program to get the statistical summary and nature of the data of a given data frame.
22.	Write a R program to extract specific column from a data frame using column name.
23.	Design a R program to create a data frame from four given vectors.
24.	Demonstrate a R program to get the structure of a given data frame.
25.	Write a R program to get the statistical summary and nature of the data of a given data frame.
26.	Design a R program to extract specific column from a data frame using column name.
27.	Demonstrate a R program to create a data frame from four given vectors.
28.	Write a R program to create a matrix taking a given vector of numbers as input. Display the matrix.
29.	Construct a R program to create a matrix taking a given vector of numbers as input and define the column and row names. Display the matrix.
30.	Write a R program to access the element at 3 <sup>rd</sup> column and 2 <sup>nd</sup> row, only the 3 <sup>rd</sup> row and only the 4 <sup>th</sup> 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.

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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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<b>Unit-I</b> <b>Introduction to Digital Marketing</b>	11



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<p>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.</p> <p><b>Email Marketing:</b> Email newsletters, Digests, Dedicated Emails, Lead Nurturing, Sponsorship Emails and Transactional Emails, Drawbacks of Email Marketing</p> <p><b>Social Media Marketing (SMM):</b> Different types of Social Media Marketing like Facebook, LinkedIn, Twitter, Video, Instagram etc.</p>	
<p><b>Unit –II</b></p> <p><b>Search Engine Optimisation (SEO)</b> About SEO, Need of an SEO friendly website, Importance of Internet and Search Engines; Role of Keywords in SEO.</p> <p><b>On-Page Optimization (Onsite):</b> 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).</p> <p><b>Off Page Optimization:</b> 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.</p>	11
<p><b>Unit-III</b></p> <p><b>Website Planning &amp; Creation</b></p> <p><b>Content Marketing Strategy:</b> Goals and concepts, Strategic building blocks, Content creation &amp; channel distribution, Tools of the trade, Advantages and challenges.</p> <p><b>Keywords Research and Analysis:</b> Introduction to Keyword Research; Business Analysis; Types of Keywords; Keywords Analysis Tools.</p> <p><b>Web Presence:</b> 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.</p>	12

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<p><b>Creating content:</b> 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.</p>	
<p><b>Unit-IV</b></p> <p><b>Online Advertising, Mobile Marketing and Web analytics</b> 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</p>	<p><b>10</b></p>

**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. Venakaramana 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](http://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

**Course Code: UGCA1953**

**Course Name: Digital Marketing Laboratory**

<b>Program: BCA</b>	<b>L: 0 T: 0 P: 4</b>
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<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 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.

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**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."

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**Course Code: UGCA1948**

**Course Name: Information Security**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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.

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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
<p><b>Unit -I</b></p> <p><b>The Security Problem in Computing:</b> 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,</p> <p>Asymmetric and symmetric Key Cryptography, Role based Security, Digital Signatures, The Data Encryption Standard, The AES Encryption Algorithms, Public Key Encryptions, Uses of Encryption.</p>	11
<p><b>Unit-II</b></p> <p><b>Security in Program and Operating System:</b> 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.</p> <p><b>Operating System:</b> Security polices, models of security, trusted Operating System design, Assurance in trusted Operating System Implementation examples.</p>	11
<p><b>Unit-III</b></p> <p><b>Database and Network Security:</b> 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</p>	11
<p><b>Unit-IV</b></p> <p><b>Administering Security:</b> 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</p>	11

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Employers, Software failures, Computer Crime, Praia, Ethical issues in Computer Security, Case Studies of Corporate Security.	
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**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**

<b>Program:</b> BCA	<b>L:</b> 0 <b>T:</b> 0 <b>P:</b> 4
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 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.

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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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<b>Unit-I</b>	12

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<p><b>Introduction</b> 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.</p>	
<p><b>Unit-II</b>  <b>Cyber Crimes&amp; Legal Framework</b> Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Ethics and Etiquettes of Cyber World, Cyber Pornography, Identity Theft &amp; 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.</p>	12
<p><b>Unit-III</b>  <b>Overview of Intellectual Property</b> 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.</p>	10
<p><b>Unit-IV</b>  <b>Copyright, Related Rights and Trademarks</b> 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?</p>	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.



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**Course Code: UGCA1955**

**Course Name: Cyber Laws & IPR Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits: 2</b>
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Theory/Practical:</b> Practical	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 60	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 40	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

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15	Discussion with reference to authentication of Electronic Record using Digital Signatures
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**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**

<b>Program:</b> BCA	<b>L:</b> 3 <b>T:</b> 1 <b>P:</b> 0
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> 40%
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<b>Unit-I</b>  <b>Introduction</b> 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
<b>Unit-II</b>  <b>Supervised Learning</b>	12

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Classification and its use cases, Decision Tree, Algorithm for Decision Tree Induction Creating a Perfect Decision Tree, Confusion Matrix, Random Forest. What is Naïve Bayes, How Naïve Bayes works, Implementing Naïve Bayes Classifier, Support Vector Machine, Illustration how Support Vector Machine works, Hyper parameter Optimization, Grid Search Vs Random Search, Implementation of Support Vector Machine for Classification.	
<b>Unit-III</b>  <b>Clustering</b> 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
<b>Unit-IV</b>  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, $\alpha$ 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 learning theory by Rodrigo fernandes de Mello and Moacir Antonelli Ponti.
5. Machine Learning A probabilistic prospective by Kevin P. Murphy

**Course Code: UGCA1956**

**Course Name: Machine Learning Laboratory**

<b>Program:</b> BCA	<b>L: 0 T: 0 P: 4</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 2
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 4 hours per week
<b>Internal max. marks:</b> 70	<b>Theory/Practical:</b> Practical
<b>External max. marks:</b> 30	<b>Duration of End Semester Exam (ESE):</b> 3hrs
<b>Total marks:</b> 100	<b>Elective status:</b> Core

**Prerequisite:** Students must have the knowledge of editors like Notepad etc. and basic understanding of Scripting Language/s.

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**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

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**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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits: 4</b>
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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

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Detailed Contents	Contact hours
<p><b>Unit-I</b></p> <p><b>Human Computer Interface</b> Concepts of Hardware and Software; Data and Information.</p> <p><b>Functional Units of Computer System:</b> CPU, registers, system bus, main memory unit, cache memory, Inside a computer, SMPS, Motherboard, Ports and Interfaces, expansion cards, ribbon cables, memory chips, processors.</p> <p><b>Devices:</b> Input and output devices (with connections and practical demo), keyboard, mouse, joystick, scanner, OCR, OMR, bar code reader, web camera, monitor, printer, plotter.</p> <p><b>Memory:</b> Primary, secondary, auxiliary memory, RAM, ROM, cache memory, hard disks, optical disks.</p> <p><b>Data Representation:</b> Bit, Byte, Binary, Decimal, Hexadecimal, and Octal Systems, Conversions and Binary Arithmetic (Addition/ Subtraction/ Multiplication) Applications of IT.</p>	12
<p><b>Unit-II</b></p> <p><b>Concept of Computing &amp; PC Software – I</b> <b>Concept of Computing, Types of Languages:</b> Machine, assembly and High level Language; Operating system as user interface, utility programs.</p> <p><b>Word processing:</b> Editing features, formatting features, saving, printing, table handling, page settings, spell-checking, macros, mail-merge, equation editors.</p>	12
<p><b>Unit-III</b></p> <p><b>PC Software – II</b> <b>Spreadsheet:</b> Workbook, worksheets, data types, operators, cell formats, freeze panes, editing features, formatting features, creating formulas, using formulas, cell references, replication, sorting, filtering, functions, Charts &amp; Graphs.</p> <p><b>Presentation Graphics Software:</b> Templates, views, formatting slide, slides with graphs, animation, using special features, presenting slide shows.</p>	10
<p><b>Unit-IV</b></p>	10

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<p><b>The Impact of Computing and the Internet on Society</b></p> <p><b>Electronic Payment System:</b> 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.</p> <p>Introduction to Bluetooth, Cloud Computing, Big Data, Data Mining, Mobile Computing and Embedded Systems and Internet of Things (IoT)</p>	
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**Text Books:**

1. Introduction to Information Technology, IITL 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](http://www.sakshat.ac.in)
2. <https://swayam.gov.in/course/4067-computer-fundamentals>

**Course Code: UGCA1903**

**Course Name: Problem Solving using C**

<b>Program:</b> BCA	<b>L: 3    T: 1    P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

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**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
<p><b>Unit-I</b></p> <p><b>Logic Development:</b> 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.</p> <p><b>Operations and Expressions:</b> Arithmetic operators, Unary operators, Relational Operators, Logical Operators, Assignment and Conditional Operators, Library functions.</p>	10
<p><b>Unit-II</b></p> <p><b>Data Input and Output:</b> formatted &amp; unformatted input output.</p> <p><b>Control Statements:</b> While, Do-while and For statements, Nested loops, If-else, Switch, Break – Continue statements.</p>	10
<p><b>Unit-III</b></p> <p><b>Functions:</b> Brief overview, defining, accessing functions, passing arguments to function, specifying argument data types, function prototypes, recursion.</p> <p><b>Arrays:</b> Defining, processing arrays, passing arrays to a function, multi-dimensional arrays.</p> <p><b>Strings:</b> String declaration, string functions and string manipulation Program Structure Storage Class: Automatic, external and static variables.</p>	12
<p><b>Unit-IV</b></p> <p><b>Structures &amp; Unions:</b> Defining and processing a structure, user defined data types, structures and pointers, passing structures to functions, unions.</p>	12



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<b>Pointers:</b> Understanding Pointers, Accessing the Address of a Variable, Declaration and Initialization of Pointer Variables, Accessing a Variable through its Pointer, Pointers and Arrays	
<b>File Handling:</b> 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++**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems: --</b>
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

CO#	Course outcomes
CO1	To learn programming from real world examples.
CO2	To understand Object oriented approach for finding Solutions to various problems with the help of C++ language.
CO3	To create computer based solutions to various real-world problems using C++
CO4	To learn various concepts of object oriented approach towards problem solving

Detailed Contents	Contact hours
Unit-I	12

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<p><b>Principles of object oriented programming</b> 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</p>	
<p><b>Unit-II</b></p> <p><b>Classes &amp; Objects and Concept of Constructors</b> 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.</p> <p>Introduction to constructors, Parameterized constructors, Copy Constructor, Multiple constructors in class, Dynamic initialization of objects, Destructors.</p>	10
<p><b>Unit-III</b></p> <p><b>Inheritance and Operator overloading</b> 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</p>	12
<p><b>Unit-IV</b></p> <p><b>Polymorphism and File Handling</b> Early Binding, Late Binding, Virtual Functions, pure virtual functions, Abstract Classes.</p> <p>Opening and Closing File, Reading and Writing a file.</p>	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  
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**Course Code: UGCA1913**

**Course Name: Computer Networks**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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
<p><b>Unit-I</b></p> <p><b>Data communications concepts:</b> Digital and analog transmissions-Modem, parallel and serial transmission, synchronous and asynchronous communication. Modes of communication: Simplex, half duplex, full duplex.</p> <p><b>Types of Networks:</b> LAN, MAN, WAN</p> <p><b>Network Topologies:</b> Bus, Star, Ring, Mesh, Tree, Hybrid</p> <p><b>Communication Channels: Wired transmissions:</b> Telephone lines, leased lines, switch line, coaxial cables-base band, broadband, optical fiber transmission.</p> <p><b>Communication Switching Techniques:</b> Circuit Switching, Message Switching, Packet Switching.</p>	12
<b>Unit-II</b>	10

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<p><b>Network Reference Models:</b> 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.</p> <p><b>Data Link Layer Design Issues:</b> Services provided to the Network Layer, Framing, Error Control (error detection and correction code), Flow Control, Data Link Layer in the Internet (SLIP, PPP)</p>	
<p><b>Unit-III</b></p> <p><b>MAC sub layer:</b> CSMA/CD/CA, IEEE standards (IEEE802.3 Ethernet, Gigabit Ethernet, IEEE 802.4 Token Bus, IEEE 802.5 Token Ring)</p> <p><b>Network Layer:</b> Design Issues, Routing Algorithms: Optimality Principle, Shortest Path Routing, Congestion Control Policies, Leaky bucket and token bucket algorithm, Concept of Internetworking.</p>	12
<p><b>Unit-IV</b></p> <p><b>Transport Layer:</b> Design issues, Elements of transport protocols – Addressing, Connection establishment and release, Flow control and buffering, Introduction to TCP/UDP protocols.</p> <p><b>Session, Presentation and Application Layers:</b> 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.</p>	10

**Text Books:**

1. Computer Networks, Tanenbaum, Andrew, Fifth Edition, PHI.
2. Data Communication and Networking, Behrouz A. Forouzan, Fourth Edition.
3. Computer Today, S.K. Basandra, First Edition, Galgotia.

**Reference Books:**

1. Data Communication System, Black, Ulysse, Third Edition, PHI.
2. Data and Computer Communications, Stalling, Ninth Edition, PHI.
3. James F. Kurose and Keith W. Ross, “Computer Networking”, Pearson Education.
4. Douglas E. Comer, “Internetworking with TCP/IP”, Volume-I, Prentice Hall, India.

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**Course Code: UGCA1922**

**Course Name: Database Management Systems**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 100	

**Prerequisite: -NA-**

**Co requisite: -NA-**

**Additional material required in ESE: -NA-**

**Course Outcomes:**

<b>CO#</b>	<b>Course outcomes</b>
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.

<b>Detailed contents</b>	<b>Contact hours</b>
<p><b>Unit-I</b></p> <p>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.</p>	10
<p><b>Unit-II</b></p> <p>Relational Database, Relational Algebra and Calculus, SQL Fundamentals, DDL, DML, DCL, PL/SQL Concepts, Cursors, Stored Procedures, Stored Functions, Database Triggers.</p>	12
<p><b>Unit-III</b></p> <p>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).</p>	12

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<b>Unit-IV</b>	
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**

<b>Program:</b> BCA	<b>L: 3 T: 1 P: 0</b>
<b>Branch:</b> Computer Applications	<b>Credits:</b> 4
<b>Semester:</b> 6 <sup>th</sup>	<b>Contact hours:</b> 44 hours
<b>Theory/Practical:</b> Theory	<b>Percentage of numerical/design problems:</b> --
<b>Internal max. marks:</b> 40	<b>Duration of end semester exam (ESE):</b> 3hrs
<b>External max. marks:</b> 60	<b>Elective status:</b> Elective
<b>Total marks:</b> 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.

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CO4	Apply different management and development practices that affect software.
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Detailed Contents	Contact hours
<p><b>Unit-I</b>            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.</p>	12
<p><b>Unit-II</b>            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.</p>	12
<p><b>Unit-III</b>            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.</p>	10
<p><b>Unit-IV</b>            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.</p>	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.

## **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.



**Scheme of**  
**Bachelor of Technology**  
**Computer Science & Engineering**  
**Batch 2018**  
**(3<sup>rd</sup> - 8<sup>th</sup> 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		
<b>BTES 301-18</b>	Engineering Science Course	Digital Electronics	3	0	0	40	60	100	3
<b>BTCS 301-18</b>	Professional Core Courses	Data structure & Algorithms	3	0	0	40	60	100	3
<b>BTCS 302-18</b>	Professional Core Courses	Object Oriented Programming	3	0	0	40	60	100	3
<b>BTAM 304-18</b>	Basic Science Course	Mathematics-III	3	0	0	40	60	100	3
<b>HSMC 101/102-18</b>	Humanities & Social Sciences Including Management \Courses	Foundation Course in Humanities (Development of Societies/Philosophy)	2	1	0	40	60	100	3
<b>BTES 302-18</b>	Engineering Science Course	Digital Electronics Lab	0	0	2	30	20	50	1
<b>BTCS 303-18</b>	Professional Core Courses	Data structure & Algorithms Lab	0	0	4	30	20	50	2
<b>BTCS 304-18</b>	Professional Core Courses	Object Oriented Programming lab.	0	0	4	30	20	50	2
<b>BTCS 305-18</b>	Professional Core Courses	IT Workshop*	0	0	2	30	20	50	1
		Summer Institutional Training	0	0	0	0	0	0	Satisfactory/Unsatisfactory
<b>Total</b>			<b>14</b>	<b>1</b>	<b>12</b>	<b>320</b>	<b>380</b>	<b>700</b>	<b>21</b>

\*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		
<b>BTCS 401-18</b>	Professional Core Courses	Discrete Mathematics	3	1	0	40	60	100	4
<b>BTES 401-18</b>	Engineering Science Course	Computer Organization & Architecture	3	0	0	40	60	100	3
<b>BTCS 402-18</b>	Professional Core Courses	Operating Systems	3	0	0	40	60	100	3
<b>BTCS 403-18</b>	Professional Core Courses	Design & Analysis of Algorithms	3	0	0	40	60	100	3
<b>HSMC 122-18</b>	Humanities & Social Sciences including Management Courses	Universal Human Values 2	2	1	0	40	60	100	3
<b>EVS101-18</b>	Mandatory Courses	Environmental Sciences	3	-	-	100	-	100	S/US
<b>BTES 402-18</b>	Engineering Science Course	Computer Organization & Architecture Lab	0	0	2	30	20	50	1
<b>BTCS 404-18</b>	Professional Core Courses	Operating Systems Lab	0	0	4	30	20	50	2
<b>BTCS 405-18</b>	Professional Core Courses	Design & Analysis of Algorithms Lab	0	0	4	30	20	50	2
<b>Total</b>			<b>15</b>	<b>2</b>	<b>10</b>	<b>290</b>	<b>360</b>	<b>650</b>	<b>24</b>

Students will take up summer internship of 4-6 weeks at industry or organizations of repute after 4<sup>th</sup> sem, that will be accredited in 5<sup>th</sup> semester.

**Fifth Semester**

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTCS 501-18</b>	Professional Core Courses	Database Management Systems	3	0	0	40	60	100	3
<b>BTCS 502-18</b>	Professional Core Courses	Formal Language & Automata Theory	3	1	0	40	60	100	3
<b>BTCS 503-18</b>	Professional Core Courses	Software Engineering	3	0	0	40	60	100	3
<b>BTCS 504-18</b>	Professional Core Courses	Computer Networks	3	0	0	40	60	100	3
<b>BTCS XXX-18</b>	Professional Elective	Elective-I	3	0	0	40	60	100	3
<b>BTCS YYY-18</b>	Professional Elective Courses	Elective-II	3	0	0	40	60	100	3
<b>BTCS 505-18</b>	Professional Core Courses	Database Management Systems Lab	0	0	4	30	20	50	2
<b>BTCS 506-18</b>	Professional Core Courses	Software Engineering Lab	0	0	2	30	20	50	1
<b>BTCS 507-18</b>	Professional Core Courses	Computer Networks Lab	0	0	2	30	20	50	1
<b>BTCS XXX-18</b>	Professional Elective	Elective-I Lab	0	0	2	30	20	50	1
<b>BTCS YYY-18</b>	Professional Elective Courses	Elective-II lab	0	0	2	30	20	50	1
		Industrial Training	0	0	0	60	40	100	Satisfactory/Un satisfactory
<b>Total</b>			<b>18</b>	<b>1</b>	<b>12</b>	<b>450</b>	<b>500</b>	<b>950</b>	<b>24</b>

**Sixth Semester**

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTCS 601-18UC</b>	Professional Core Courses	Compiler Design	3	0	0	40	60	100	3
<b>BTCS 602-18UC</b>	Professional Core Courses	Artificial Intelligence	3	1	0	40	60	100	3
<b>BTCS ZZZ-18UC</b>	Professional Elective Courses	Elective-III	3	0	0	40	60	100	3
<b>BTCS UUU-18UC</b>	Professional Elective Courses	Elective-IV	3	0	0	40	60	100	3
<b>BTOE ***</b>	Open Elective Courses	Open Elective-I	3	0	0	40	60	100	3
<b>BTCS 603-18UC</b>	Project	Project-1	0	0	6	60	40	100	3
<b>BTCS 604-18UC</b>	Professional Core Courses	Compiler Design Lab	0	0	2	30	20	50	1
<b>BTCS 605-18UC</b>	Professional Core Courses	Artificial Intelligence Lab	0	0	2	30	20	50	1
<b>BTCS ZZZ-18UC</b>	Professional Elective Courses	Elective-III Lab	0	0	2	30	20	50	1
<b>BTCS UUU-18UC</b>	Professional Elective Courses	Elective-IV Lab	0	0	2	30	20	50	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>14</b>	<b>380</b>	<b>420</b>	<b>800</b>	<b>22</b>

**Seventh Semester**

Course Code	Course Type	Course Title	Load Allocations			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTCS VVV-18UC</b>	Professional Elective	Elective-V	3	0	0	40	60	100	3
<b>BTCS TTT-18UC</b>	Professional Elective Courses	Elective-VI	3	0	0	40	60	100	3
<b>BTOE ***</b>	Open Elective Courses	Open Elective-II	3	0	0	40	60	100	3
<b>BTOE ***</b>	Open Elective Courses	Open Elective- III	3	0	0	40	60	100	3
<b>BTCS 701-18UC</b>	Professional Core Courses	Machine Learning	3	0	0	40	60	100	3
<b>BTCS 702-18UC</b>	Project	Project-II	0	0	12	120	80	200	6
<b>BTCS 703-18UC</b>	Professional Core Courses	Machine Learning Lab	0	0	2	30	20	50	1
<b>BTCS VVV-18UC</b>	Professional Elective	Elective-V lab	0	0	2	30	20	50	1
<b>BTCS TTT-18UC</b>	Professional Elective Courses	Elective-VI lab	0	0	2	30	20	50	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>18</b>	<b>410</b>	<b>440</b>	<b>850</b>	<b>24</b>

**Eighth Semester**

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
<b>BTCS 801-18UC</b>	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 Course 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		
<b>BTCS H01-18</b>	Professional Elective Courses	Graph Theory	3	0	0	40	60	100	3
<b>BTCS H02-18</b>	Professional Elective Courses	Computer Vision	3	0	0	40	60	100	3
<b>BTCS 618-18</b>	Professional Elective Courses	Embedded Systems	3	0	0	40	60	100	3
<b>BTCS H03-18</b>	Professional Elective Courses	Software Project Management	3	0	0	40	60	100	3
<b>BTCS H04-18</b>	Professional Elective Courses	Cryptography & Network Security	3	0	0	40	60	100	3
<b>BTCS H05-18</b>	Professional Elective Courses	Internet-of-Things	3	0	0	40	60	100	3
<b>BTCS 805-18</b>	Professional Elective Courses	Data Analytics	3	0	0	40	60	100	3
<b>BTCS 701-18</b>	Professional Elective Courses	Machine Learning	3	0	0	40	60	100	3
<b>BTCS H06-18</b>	Professional Elective Courses	ICT in Agriculture and Rural Development	3	0	0	40	60	100	3
<b>BTCS H07-18</b>	Professional Elective Courses	Computational Technologies for Smart Cities	3	0	0	40	60	100	3
<b>BTCS H08-18</b>	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*

<b>Course Code:</b> BTCS301-18	<b>Course Title:</b> Data Structure & Algorithms	<b>3L:0T:0P</b>	<b>3Credits</b>
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### **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, 2<sup>nd</sup> 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
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**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/O: 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.
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Course Code: BTCS303-18	Course Title: Data Structure & Algorithms Lab	0L:0T:4P	2Credits
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### **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
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**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
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**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<sup>th</sup> 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<sup>th</sup> 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):

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

#### 2.2 Unit 2:

Origin of the Universe:

- Nasidiya Sukta: "Who really knows?"
- Bṛhadāranyaka 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's Vakyapadiyam)
- 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

- 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 R̥gveda. 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, MotilalBanarasidas, 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
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### 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 and 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 Hill Publishing Company Limited, 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**, Pearson Education.
  - Ghosal ,**Digital Electronics**, Cengage Learning.
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Course Code:BTES302-18	Course Title: Digital Electronics Lab	0L:0T:2P	1Credits
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**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
- .....

# *Fourth Semester*

<b>Course Code:</b> BTES401-18	<b>Course Title:</b> Computer Organization & Architecture	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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
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**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, Dining 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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<b>Course Code:</b> BTCS403-18	<b>Course Title:</b> Design and Analysis of Algorithms	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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, 4<sup>th</sup> edition, Pearson.

3. Fundamentals of Computer Algorithms – E. Horowitz, Sartaj Saini, Galgota Publications.

**Reference Books**

1. Algorithm Design, 1<sup>st</sup>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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<b>Course Code:</b> BTES402-18	<b>Course Title:</b> Computer Organization & Architecture Lab	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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
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**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
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**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, 4<sup>th</sup> 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 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.

#### **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 Prosperity in detail
6. 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**

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 the meaning of Trust; Difference between intention and competence
3. Understanding the 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,
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 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: 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 - JCKumarappa
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	3L:0T:0P	0Credits
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## 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

- Introduction – Definition : genetic, species and ecosystem diversity.
- Biodiversity at global, National and local levels.
- India as a mega-diversity nation
- Hot-spots 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 rehabilitation of people; its problems and concerns.
- Environmental ethics : Issues and possible solutions.
- Climate change, global warming, acid rain, ozone layer depletion, Nuclear accidents and holocaust. Case Studies.
- Public awareness.

#### \*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
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**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
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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 Rgveda. 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, Motilal Banasidas, 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. Bhattacharyas, 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.

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



<b>Course Code: BTCS501-18</b>	<b>Course Title: Database Management Systems</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
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**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.

**Suggested reference books**

- 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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<b>Course Code : BTCS 502-18</b>	<b>Course Title: Formal Language &amp; Automata Theory</b>	<b>3L:1T:0P</b>	<b>3Credits</b>
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### 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 of 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)

**Module 6: Undecidability** Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's 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.
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<b>Course Code: BTCS 503-18</b>	<b>Course Title : Software Engineering</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
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**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.
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<b>Course Code: BTCS 504 -18</b>	<b>Course Title: Computer Networks</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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**, 4<sup>th</sup> Edition, Behrouz A. Forouzan, McGraw-Hill.
2. **Data and Computer Communication**, 8<sup>th</sup> 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, 6<sup>th</sup> Edition Douglas Comer, Prentice Hall of India.
  3. **TCP/IP Illustrated**, Volume1, W. Richard Stevens, Addison-Wesley, United States of America.
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## Elective-I

Course Code: BTCS 508-18	Course Title: Programming in JAVA	3L:0T:0P	3 Credits
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### 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 operators, 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**, 6<sup>th</sup> 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**, 2<sup>nd</sup> Edition, Shroff Publishers.

Course Code: BTCS 509-18	Course Title: Web and Open Source Technologies	3L:0T:0P	3 Credits
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### 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, XMLHttpRequest, 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.
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<b>Course Code: BTCS 510-18</b>	<b>Course Title: Programming in Python</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
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**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, Web 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.
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## Elective-II

Course Code: BTCS 514-18	Course Title: Mobile Application Development	3L:0T:0P	3 Credits
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### 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**”, 1st 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**”, 1st Edition, 2012.
  5. Reto Meier, “**Professional Android 4 Application Development**”, Wrox, 2012.
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Course Code: BTCS 515-18	Course Title: Computer Graphics	3L:0T:0P	3 Credits
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**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
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### 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 Madiseti, Arshdeep Bahga, **Internet 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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<b>Course Code: BTCS 505-18</b>	<b>Course Title: Database management System lab</b>	<b>0L:0T:4P</b>	<b>2 Credits</b>
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**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 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.

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<b>Course Code: BTCS506-18</b>	<b>Course Title: Software Engineering Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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.

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<b>Course Code: BTCS507-18</b>	<b>Course Title: Computer Networks Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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 subnetting.
  5. Configure routers using various router configuration commands.
  6. Troubleshoot the networks by using various networking commands. Graphics Software's.
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## Elective-I Lab

Course Code: BTCS511-18	Course Title: Programming in Java Lab	0L:0T:2P	1Credits
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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 operators, 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
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Course Code: BTCS 512-18	Course Title: Web and Open Source Technologies Laboratory	0L:0T:2P	1Credits
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**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.
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<b>Course Code: BTCS 513-18</b>	<b>Course Title: Programming in Python Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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  $\text{pow}(x, n)$
19. Write a Python class to reverse a string word by word.

## Elective-II Lab

<b>Course Code: BTCS 517-18</b>	<b>Course Title: Mobile Application Development Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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### 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
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<b>Course Code: BTCS518-18</b>	<b>Course Title: Computer Graphics Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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
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<b>Course Code: BTCS 519-18</b>	<b>Course Title: Internet of Things Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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.
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# *Sixth Semester*

**Detailed Contents:**

Course Code: BTCS601-18UC	Course Title : Compiler Design	3L:0T:0P	3 Credits
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**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. Loudon, "Compiler Construction: Principles and Practice", Thompson Learning, 2003
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<b>Course Code: BTCS602-18UC</b>	<b>Course Title : Artificial Intelligence</b>	<b>3L:1T:0P</b>	<b>3 Credits</b>
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**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.
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<b>Course Code: BTCS606-18UC</b>	<b>Course Title: Network Security and Cryptography</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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, 4<sup>th</sup> Edition by William Stallings, Pearson Education.
  2. Security in Computing, 2<sup>nd</sup> Edition by Charles P.Pfleeger, Prentice Hall International.
  3. Cryptography & Network Security, 2<sup>nd</sup> Edition by Atul Kahate, TMH.
  4. Applied Cryptography: Protocols, Algorithms, and Source Code in C, 2<sup>nd</sup> Edition by Bruce Schneier, John Wiley and Sons.
  5. Firewalls and Internet Security, 2<sup>nd</sup> 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.
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Course Code: BTCS607-18UC	Course Title : Data Mining	3L: 0T: 0P	3Credits
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**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.

### **Course Outcomes:**

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
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Course Code: BTCS608-18UC	Course Title : Cloud Computing	3L:0T:1	3 Credits
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**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)

### **Course Outcomes:**

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

### **Text Books:**

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
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Course Code: BTCS612-18UC	Course Title : Information Theory and Coding	3L:0T:0P	3Credits
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**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)

**Course Outcomes:**

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.

**Text Books:**

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, 3<sup>rd</sup> edition
3. Information Theory and Coding: Basics and Practices, V, Veluswamy, New Age International Pvt. ltd., 2014, 1<sup>st</sup> 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

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Course Code:BTCS613-18UC	Course Title: Data Science	3L:0T:0P	3 Credits
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**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, Architecture 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
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**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.
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Course Code: BTCS618-18UC	Course Title : Internet of Things	3L:0T:0P	3Credits
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**Detailed 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, 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 Madiseti, Arshdeep Bahga, Internet 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
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#### **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
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**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**

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<b>Course Code: BTCS605-18UC</b>	<b>Course Title: Artificial Intelligence Laboratory</b>	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**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.

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Course Code: BTCS609-18UC	Course Title: Network Security and Cryptography Lab	0L:0T:2P	1Credits
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**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)
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<b>Course Code: BTCS610-18UC</b>	<b>Course Title: Data Mining Lab</b>	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**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

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<b>Course Code: BTCS611-18UC</b>	<b>Course Title: Cloud Computing Lab</b>	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**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

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Course Code: BTCS615-18UC	Course Title: Information Theory and Coding Lab	0L:0T:2P	1 Credits
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**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 – Fanocoding and 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**

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<b>Course Code: BTCS616-18UC</b>	<b>Course Title: Data Science Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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.**

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<b>Course Code: BTCS617-18UC</b>	<b>Course Title: Soft Computing Lab</b>	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**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**

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# Seventh Semester

Course Code: BTCS 701-18UC	Course Title : Machine Learning	3L:0T:0P	3Credits
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## 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
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**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**

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<b>Course Code: BTCS704-18UC</b>	<b>Course Title: Quantum Computing</b>	<b>3L: 0T: 0P</b>	<b>3 Credits</b>
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**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.
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<b>Course Code: BTCS707-18UC</b>	<b>Course Title: Quantum Computing Lab</b>	<b>L:0 T:0 P:0</b>	<b>1 Credits</b>
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**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.
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<b>Course Code: BTCS 705-18UC</b>	<b>Course Title: Big Data Analytics</b>	<b>L:3 T:0 P:0</b>	<b>3 Credits</b>
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**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:** Operationalizing 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
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<b>Course Code: BTCS 708-18UC</b>	<b>Course Title: Big Data Analytics Lab</b>	<b>L:0 T:0 P:2</b>	<b>1 Credits</b>
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**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
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<b>Course Code: BTCS706-18UC</b>	<b>Course Title: Speech and Natural Language Processing</b>	<b>3L:0 T: 0P</b>	<b>Credits: 3</b>
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**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.

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<b>Course Code: BTCS706-18UC</b>	<b>Course Title: Speech and Natural Language Processing</b>	<b>0L:0 T: 2P</b>	<b>Credits: 1</b>
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**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
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Course Code: BTCS710-18UC	Course Title: Block Chain Technology	3L:0 T: 0P	Credits: 3
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### 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

#### **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 Ethereum platform to implement the Block chain Application.

#### **Text Books:**

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.

<b>Course Code: BTCS713-18UC</b>	<b>Course Title: Block chain Technology Lab</b>	<b>L:0 T:0 P:2</b>	<b>Credits:1</b>
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**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.

<b>Course Code: BTCS711-18UC</b>	<b>Course Title : Software Defined Networking</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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.

<b>Course Code:</b> BTCS714-18UC	<b>Course Title:</b> Software Defined Networking Lab	<b>L:0 T:0 P:2</b>	<b>1 Credits</b>
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**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 topologies in mininet using low-level API.
- 4.Create custom topologies in mininet using mid-level API.
- 5.Create custom topologies 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
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**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.

[7hrs] (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. William 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

<b>Course Code:</b> BTCS715-18UC	<b>Course Title:</b> Digital Image Processing Lab	<b>L:0 T:0 P:2</b>	<b>1 Credits</b>
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**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**

<b>Course Code: BTCS717-18UC</b>	<b>Course Title: Parallel Computing</b>	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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**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 Metrics:** Laws governing performance measurements. Metrics - 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.**

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<b>Course Code: BTCS718-18UC</b>	<b>Course Title: Symbolic Logic &amp; Logic Processing</b>	<b>3L: 0T: 0P</b>	<b>Credits: 3</b>
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**Detailed Contents:**

**UNIT-I**

**Propositional Logic:** syntax and semantics: Validity and consequence. Normal forms. Representing world knowledge using propositional 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.
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# **Scheme of Bachelor of Technology Computer Science & Engineering**

**Batch 2019 onwards  
(3<sup>rd</sup> - 8<sup>th</sup> 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: Third Semester**

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTES 301-18</b>	Engineering Science Course	Digital Electronics	3	0	0	40	60	100	3
<b>BTCS 301-18</b>	Professional Core Courses	Data structure & Algorithms	3	1	0	40	60	100	3
<b>BTCS 302-18</b>	Professional Core Courses	Object Oriented Programming	3	0	0	40	60	100	3
<b>BTAM 304-18</b>	Basic Science Course	Mathematics-III	4	1	0	40	60	100	3
<b>HSMC 101/102-18</b>	Humanities & Social Sciences Including Management \Courses	Foundation Course in Humanities (Development of Societies/Philosophy)	2	1	0	40	60	100	3
<b>BTES 302-18</b>	Engineering Science Course	Digital Electronics Lab	0	0	2	30	20	50	1
<b>BTCS 303-18</b>	Professional Core Courses	Data structure & Algorithms Lab	0	0	4	30	20	50	2
<b>BTCS 304-18</b>	Professional Core Courses	Object Oriented Programming lab.	0	0	4	30	20	50	2
<b>BTCS 305-18</b>	Professional Core Courses	IT Workshop*	0	0	2	30	20	50	1
		Summer Institutional Training	0	0	0	60	40	100	Satisfactory/Unsatisfactory
<b>Total</b>			<b>15</b>	<b>3</b>	<b>12</b>	<b>380</b>	<b>420</b>	<b>800</b>	<b>21</b>

\*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		
<b>BTCS 401-18</b>	Professional Core Courses	Discrete Mathematics	3	1	0	40	60	100	4
<b>BTES 401-18</b>	Engineering Science Course	Computer Organization & Architecture	3	1	0	40	60	100	3
<b>BTCS 402-18</b>	Professional Core Courses	Operating Systems	3	1	0	40	60	100	3
<b>BTCS 403-18</b>	Professional Core Courses	Design & Analysis of Algorithms	3	1	0	40	60	100	3
<b>HSMC 122-18</b>	Humanities & Social Sciences including Management Courses	Universal Human Values-II	2	1	0	40	60	100	3
<b>EVS101-18</b>	Mandatory Courses	Environmental Sciences	1	-	-	-	-	-	0
<b>BTES 402-18</b>	Engineering Science Course	Computer Organization & Architecture Lab	0	0	2	30	20	50	1
<b>BTCS 404-18</b>	Professional Core Courses	Operating Systems Lab	0	0	4	30	20	50	2
<b>BTCS 405-18</b>	Professional Core Courses	Design & Analysis of Algorithms Lab	0	0	4	30	20	50	2
<b>Total</b>			<b>15</b>	<b>5</b>	<b>10</b>	<b>290</b>	<b>360</b>	<b>650</b>	<b>21</b>

**Fifth Semester**

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTES 501-18</b>	Engineering Science	Enterprise Resource Planning	3	0	0	40	60	100	3
<b>BTCS 501-18</b>	Professional Core Courses	Database Management Systems	3	0	0	40	60	100	3
<b>BTCS 502-18</b>	Professional Core Courses	Formal Language & Automata Theory	3	0	0	40	60	100	3
<b>BTCS 503-18</b>	Professional Core Courses	Software Engineering	3	0	0	40	60	100	3
<b>BTCS 504-18</b>	Professional Core Courses	Computer Networks	3	0	0	40	60	100	3
<b>BTCS XXX-18</b>	<b>Professional Elective</b>	<b>Elective-I</b>	<b>3</b>	<b>0</b>	<b>0</b>	<b>40</b>	<b>60</b>	<b>100</b>	<b>3</b>
<b>MC</b>	Mandatory Courses	Constitution of India/ Essence of Indian Traditional Knowledge	2	-	-	100	-	100	S/US
<b>BTCS 505-18</b>	Professional Core Courses	Database Management Systems Lab	0	0	4	30	20	50	2
<b>BTCS 506-18</b>	Professional Core Courses	Software Engineering Lab	0	0	2	30	20	50	1
<b>BTCS 507-18</b>	Professional Core Courses	Computer Networks Lab	0	0	2	30	20	50	1
<b>BTCS XXX-18</b>	<b>Professional Elective</b>	<b>Elective-I Lab</b>	<b>0</b>	<b>0</b>	<b>2</b>	<b>30</b>	<b>20</b>	<b>50</b>	<b>1</b>
	Professional Training	Industrial *Training	-	-	-	60	40	100	S/US
<b>Total</b>			<b>20</b>	<b>0</b>	<b>10</b>	<b>460</b>	<b>440</b>	<b>900</b>	<b>23</b>

\* 4-6 weeks industrial training undertaken after 4<sup>th</sup> 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		
<b>BTCS 601-18</b>	Professional Core Courses	Compiler Design	3	0	0	40	60	100	3
<b>BTCS 602-18</b>	Professional Core Courses	Artificial Intelligence	3	0	0	40	60	100	3
<b>BTCS UUU-18</b>	Professional Elective Courses	Elective-II	3	0	0	40	60	100	3
<b>BTCS YYY-18</b>	Professional Elective Courses	Elective-III	3	0	0	40	60	100	3
<b>BTOE ***</b>	Open Elective Courses	Open Elective-I	3	0	0	40	60	100	3
<b>BTCS 603-18</b>	Project	Project-1	0	0	6	60	40	100	3
<b>BTCS 604-18</b>	Professional Core Courses	Compiler Design Lab	0	0	2	30	20	50	1
<b>BTCS 605-18</b>	Professional Core Courses	Artificial Intelligence Lab	0	0	2	30	20	50	1
<b>BTCS UUU-18</b>	Professional Elective Courses	Elective-II lab	0	0	2	30	20	50	1
<b>BTCS YYY-18</b>	Professional Elective Courses	Elective-III lab	0	0	2	30	20	50	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>14</b>	<b>380</b>	<b>420</b>	<b>800</b>	<b>22</b>

**Seventh Semester**

Course Code	Type of Course	Course Title	Hours per Week			Marks Distribution		Total Marks	Credits
			L	T	P	Internal	External		
<b>BTCS 701-18</b>	Professional Core Courses	Network Security and Cryptography	3	0	0	40	60	100	3
<b>BTCS 702-18</b>	Professional Core Courses	Data Mining and Data Warehousing	3	0	0	40	60	100	3
<b>BTOE ***</b>	Open Elective Courses	Open Elective-II	3	0	0	40	60	100	3
<b>BTCS ZZZ-18</b>	Professional Elective	Elective- IV	3	0	0	40	60	100	3
<b>BTCS TTT-18</b>	Professional Elective Courses	Elective-V	3	0	0	40	60	100	3
<b>BTCS 703-18</b>	Project	Project-II	0	0	12	120	80	200	6
<b>BTCS ZZZ-18</b>	Professional Elective	Elective- IV lab	0	0	2	30	20	50	1
<b>BTCS TTT-18</b>	Professional Elective	Elective- V lab	0	0	2	30	20	50	1
<b>Total</b>			<b>15</b>	<b>0</b>	<b>14</b>	<b>380</b>	<b>420</b>	<b>800</b>	<b>23</b>

**Eighth Semester**

Course Code	Course Title	Marks Distribution		Total Marks	Credits
		Internal	External		
<b>BTCS 801-18</b>	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 Oriented Programming

**BTES401-18** Computer organisation & Arcitecture

**BTCS402-18** Operating system

**BTCS501-18** Database Management System

**BTCS504-18** Computer Networks

# *Third Semester*

<b>Course Code:</b> BTCS301-18	<b>Course Title:</b> Data Structure & Algorithms	<b>3L:1T:P</b>	<b>3Credits</b>
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**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 be 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 be 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, 2<sup>nd</sup> 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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<b>Course Code:</b> BTCS302-18	<b>Course Title:</b> Object Oriented Programming	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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/O: 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.
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<b>Course Code:</b> BTCS303-18	<b>Course Title:</b> Data Structure & Algorithms Lab	<b>0L:0T:4P</b>	<b>2Credits</b>
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**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 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
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**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.

<b>Course Code:</b> BTAM304-18	<b>Course Title:</b> Mathematics Paper-III (Calculus and Ordinary Differential Equations)	<b>4L:1T:0P</b>	<b>4 credits</b>
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**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<sup>th</sup> 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<sup>th</sup> 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 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 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's Vakyapadiyam)
- 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 R̥gveda. 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, Motilal Banasidas, 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.

<b>Course Code:</b> BTES301-18	<b>Course Title:</b> Digital Electronics	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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 and 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 Hill Publishing Company Limited, New Delhi, 2003.
3. R.P. Jain, **Modern Digital Electronics**, 3 ed., Tata McGraw-Hill publishing company limited, New Delhi, 2003.
4. Thomas L. Floyd, **Digital Fundamentals**, Pearson Education, Inc, New Delhi, 2003

5. Ronald J. Tocci, Neal S. Widmer, Gregory L. Moss, **Digital System - Principles and Applications**, Pearson Education.
  6. Ghosal, **Digital Electronics**, Cengage Learning.
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<b>Course Code:BTES302-18</b>	<b>Course Title: Digital Electronics Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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 Decoder circuits
- Task 5:** To realize Multiplexer circuits
- Task 6:** To realize 4-bit binary-gray & gray-binary converters.
- 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*

<b>Course Code:</b> BTES401-18	<b>Course Title:</b> Computer Organization & Architecture	<b>3L:1T:0P</b>	<b>3Credits</b>
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**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.
- .....

Course Code: BTCS402-18	Course Title: Operating Systems	3L:1T:0P	3Credits
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**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, Dining 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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<b>Course Code:</b> BTCS403-18	<b>Course Title:</b> Design and Analysis of Algorithms	<b>3L:1T:0P</b>	<b>3Credits</b>
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**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, 4<sup>th</sup> edition, Pearson.
3. Fundamentals of Computer Algorithms – E. Horowitz, Sartaj Saini, Galgota Publications.

**Reference Books**

1. Algorithm Design, 1<sup>st</sup> 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, 3<sup>RD</sup> Edition, Udi Manber, Addison-Wesley, Reading, MA.
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<b>Course Code:</b> BTES402-18	<b>Course Title:</b> Computer Organization & Architecture Lab	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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
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**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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<b>Course Code:</b> BTCS405-18	<b>Course Title:</b> Design and Analysis of Algorithms Lab	<b>0L:0T:4P</b>	<b>2Credit</b>
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**List of Experiment:**

- Task 1:** Code and analyze solutions to following problem with given strategies:
- Knap Sack using greedy approach
  - 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:
- to find the topological sort of a directed acyclic graph
  - to find a path from source to goal in a maze.
- Task 5:** Implement an application of BFS such as:
- to find connected components of an undirected graph
  - 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:

- Improve practical skills in designing and implementing complex problems with different techniques;
- Understand comparative performance of strategies and hence choose appropriate, to apply to specific problem definition;
- Implement Various tree and graph based algorithms and become familiar with their design methods; &
- Design and Implement heuristics for real world problems.

**Reference Books**

- Data Structures and Algorithms in C++, Weiss, 4<sup>th</sup> edition, Pearson
  - 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 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 Prosperity in 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 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 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
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### **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-spots 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

**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,
  15. USA 499p
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<b>Course Code:</b> HSMC101- 18	<b>Course Title:</b> Development of Societies	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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.
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Course Code: HSMC102-18	Course Title: PHILOSOPHY	3L:0T:0P	3Credits
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### **Detailed Contents:**

#### **Unit 1:**

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

- Upanishads;
- Six systems orthodox and Heterodox Schools of Indian Philosophy.
- 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's Vakyapadiyam)
- 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**

- Copleston, Frederick, History of Philosophy, Vol. 1. Great Britain: Continuum.
- Hiriyanna, M. Outlines of Indian Philosophy, Motilal Banarsidass Publishers; Fifth Reprint edition (2009)
- Sathaye, Avinash, Translation of Nasadiya Sukta
- Ralph T. H. Griffith. The Hymns of the Rgveda. Motilal Banarsidass: Delhi: 1973.
- 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. Bhattacharyas, 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.

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<b>Course Code:</b> BTCS401-18	<b>Course Title:</b> Discrete Mathematics	<b>3L:1T:0P</b>	<b>4 Credits</b>
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**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*

<b>BTES501-18</b>	<b>Enterprise Resource Planning</b>	<b>3L:0T:0P</b>	<b>3 Credits</b>
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**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

<b>Course Code:</b> BTCS501-18	<b>Course Title:</b> Database Management Systems	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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”, Voll by J. D. Ullman, Computer Science Press.
  2. “Fundamentals of Database Systems”, 5<sup>th</sup> 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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<b>Course Code:</b> BTCS502-18	<b>Course Title:</b> Formal Language & Automata Theory	<b>3L:1T:0P</b>	<b>3Credits</b>	<b>42 Hours</b>
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### 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 & Intractability:**

Church-Turing thesis, universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.  
Intractability: 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.
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<b>Course Code:</b> BTCS503-18	<b>Course Title:</b> Software Engineering	<b>3L:1T:0P</b>	<b>3Credits</b>	<b>42 Hours</b>
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**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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<b>Course Code:</b> BTCS 504-18	<b>Course Title:</b> Computer Networks	<b>3L:1T:0P</b>	<b>3Credits</b>	<b>42 Hours</b>
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### **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.

<b>Course Code:</b> BTCS505-18	<b>CourseTitle:</b> Database management System lab	<b>0L:0T:4P</b>	<b>2Credits</b>
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**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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<b>Course Code:</b> BTCS506-18	<b>Course Title:</b> Software Engineering Lab	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**List of Experiments:**

- Task 1:** Study and usage of OpenProj or similar software to draft a project plan
- Task 2:** Study and usage of OpenProj or similar software to track the progress of a project
- Task 3:** Preparation of Software Requirement Specification Document, Design Documents and Testing Phase
- Task 4:** related documents for some problems
- Task 5:** Preparation of Software Configuration Management and Risk Management related documents
- Task 6:** Study and usage of any Design phase CASE tool
- Task 7:** To perform unit testing and integration testing
- Task 8:** To perform various white box and black box testing techniques
- Task 9:** Testing of a web site

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

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<b>Course Code:</b> BTCS507-18	<b>Course Title:</b> Computer Networks Lab	<b>0L:0T:2P</b>	<b>1 Credits</b>
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**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***

<b>Course Code:</b> BTCS 510-18	<b>Course Title:</b> Programming in Python	<b>3L:0T:0P</b>	<b>3 Credits</b>	<b>42 Hours</b>
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## **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, Web 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.

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<b>Course Code:</b> BTCS 513-18	<b>Course Title:</b> Programming in Python Lab	<b>0L:0T:2P</b>	<b>1 Credits</b>	<b>2 Hours/week</b>
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**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.

<b>Course Code:</b> BTCS521-	<b>Course Title:</b> Computational Biology	<b>3L:0T:0P</b>	<b>3 Credits</b>	<b>42 Hours</b>
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### **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, Krebs'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.
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<b>Course Code:</b> BTCS523-18	<b>Course Title:</b> Computational Biology Lab	<b>0L:0T:2P</b>	<b>1 Credits</b>	<b>2 Hours/week</b>
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**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](https://biopython.readthedocs.io/en/latest/Tutorial/chapter_seq_objects.html)

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**Detailed Contents:**

**Module 1:**

Overview of Computer Graphics: Basics of Computer Graphics, Applications, Video Display devices, Raster–Scan displays, Random–Scan displays, Color CRT Monitors, Flat–Panel Displays; Video Controller, Display Processor, Common Graphic Input and Output devices, Graphic File Formats, Graphics Software’s.

**[6hrs] (CO1)**

**Module 2:**

Output Primitives: Line Drawing, DDA, Bresenham Line Algorithm; Mid-Point Line Algorithm, Bresenham Circle Algorithm, Midpoint Circle drawing algorithms; Midpoint Ellipse Algorithm; Flood and Boundary Filling.

**[6hrs] (CO1)**

**Module 3:**

Two-Dimensional Geometric Transformation: Translation, Rotation, Scaling, Reflection, Shearing, Matrix representations; Composite transformations.

**[6hrs] (CO1,2)**

**Module 4:**

Two-Dimensional Viewing: Viewing coordinate reference frame; Window to Viewport coordinate transformation. Point Clipping, Line Clipping, text Clipping; Cohen–Sutherland and Liang–Barskey Algorithms for line clipping; Sutherland–Hodgeman algorithm for polygon clipping.

**[6hrs](CO2)**

**Module 5:**

Three Dimensional Transformations & Viewing: Translation, Rotation, Scaling, Reflection and composite transformations. Parallel and Perspective Projections, Viewing Transformation: View Plan, View Volumes and Clipping.

**[6hrs] (CO2)**

**Module 6:**

3 D Graphics and Visibility: Plane projections and its types, Vanishing points, Specification of a 3D view. Image and object precision, Hidden edge/surface removal or visible edge/surface determination techniques; z buffer algorithms, Depth sort algorithm, Scan line algorithm and Floating horizon technique.

**[6hrs] (CO2,3)**

**Module 7:**

Color Models: Properties of Light, Intuitive Color Concepts, concepts of chromaticity, RGB Color Model, CMY Color Model, HLS and HSV Color Models, Conversion between RGB and CMY color Models, Conversion between HSV and RGB color models, Color Selection and Applications.

**[6hrs] (CO2,3)**

**Module 8:**

Animation: Graphics Design of Animation sequences, General Computer Animation Functions Introduction to Rendering, Raytracing, Antialiasing, Fractals, Gourard and Phong shading.

**[3hrs] (CO3)**

**Reference Books:**

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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<b>Course Code:</b> BTCS 518-18	<b>Course Title:</b> Computer Graphics Lab	<b>0L:0T:4P</b>	<b>2 Credits</b>	<b>2 Hours/ week</b>
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**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.
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<b>Course Code:</b> BTCS 520-18	<b>Course Title:</b> Web Technologies	<b>3L:0T:0P</b>	<b>3 Credits</b>	<b>42 Hours</b>
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**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”, Pearson Education
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.

<b>Course Code:</b> BTCS 522-18	<b>Course Title:</b> Web Technologies Lab	<b>0L:0T:2P</b>	<b>1 credits</b>	<b>2 Hours/ week</b>
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**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
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**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: Understand 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.

<b>Course Code:</b> BTCS604-18	<b>Course Title: Compiler Design Lab</b>	<b>L:0;T:0; 2P</b>	<b>1Credits</b>
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**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.

<b>Course Code:BTCS602-18</b>	<b>Course Title : Artificial Intelligence</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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 uncertainty

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 Artificial 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

<b>Course Code:</b> <b>BTCS 605-18</b>	<b>Course Title</b> Artificial Intelligence Lab	<b>L:0;T:0;2</b> <b>P:</b>	<b>1 Credits</b>
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**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

<b>Course Code:</b> BTCS 606-18	<b>Course Title:</b> Simulation and Modeling	<b>3L:0T:0P</b>	<b>3Credits</b>
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## 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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<b>Course Code:</b> BTCS 607-18	<b>Course Title:</b> Simulation and Modeling Lab	<b>L:0;T:0; P:</b>	<b>Credits</b>
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**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.

**Suggested Tools** - Scilab, Tortuga and Extend. Introduction to network simulators - NS2, CloudSim, Wireshark.

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Course Code: BTCS608-18	Course Title:Internet of Things	L:3; T:0; P:0	3Credits
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## 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 Madiseti, Arshdeep Bahga, ĩnternet 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

<b>Course Code: BTCS609-18</b>	<b>Course Title: Internet of Things Lab</b>	<b>L:0; T:0; P:2</b>	<b>1Credits</b>
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### 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
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**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.

[7hrs] (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)

**UNIT 4: 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. William 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
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Course Code:BTCS 611-18	Course Title: Digital Image Processing Lab	L:0;T:0; P:	Credits
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**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**

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**Detailed Contents:**

<b>UNIT1: Introduction</b> : Definition of cloud, characteristics of cloud, historical developments & challenges			
<b>Course Code: BTCS 612-18</b>	<b>Course Title: Cloud Computing</b>	<b>3L:0T:0P</b>	<b>3Credits</b>

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.



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<b>Course Code: BTCS 612-18</b>	<b>Course Title: Cloud Computing Lab</b>	<b>L:0;T:0; P:2</b>	<b>1 Credits</b>
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**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**

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# ELECTIVE III

Course Code: BTCS 614-18	Course Title: Software Project Management	3L:0T:0P	3 Credits
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## 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

<b>Course Code: BTCS 615-18</b>	<b>Course Title: Software Project Management Lab</b>	<b>L:0;T:0; P:2</b>	<b>1 Credits</b>
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**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
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**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

<b>Course Code: BTCS 617-18</b>	<b>Course Title : Data Science Lab</b>	<b>0L:0T:2P</b>	<b>1Credits</b>
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**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**

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Course Code: BTCS 618-18	Course Title : Machine Learning	3L:0T:0P	3Credits
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### 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).

<b>Course Code: BTCS619-18</b>	<b>Course Title: machine Learning Lab</b>	<b>L:0;T:0;2 P:</b>	<b>1Credits</b>
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**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**

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Course Code: BTCS620-18	Course Title: Mobile Application Development	L:3; T:0; P:0	3Credits
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**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

<b>Course Code: BTCS621-18</b>	<b>Course Title: Mobile Application Development Lab</b>	<b>L:0; T:0; P:2</b>	<b>1Credits</b>
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### 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

<b>Course Code: BTCS 701-18</b>	<b>Course Title : Network Security and Cryptography</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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) : Feistel Cipher Structure, Simplified 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.
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Course Code: BTCS - 702-18	Course Title: Data Warehousing and Data Mining	3L: 0T: 0P	Credits: 3
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## 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 Verrellis, 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, Pearson education press (1996), 1st ed.
5. Pooniah P. , Data Warehousing Fundamentals, Willey interscience Publication, (2001), 1st ed.

# ELECTIVE IV

Course Code: <b>BTCS 704-18</b>	Course Title : <b>Deep Learning</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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## 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: <b>BTCS 705-18</b>	Course Title: <b>Deep Learning Lab</b>	L:0;T:0; 2P:	Credits;1
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**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**

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**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.

<b>Course Code: BTCS 710-18</b>	<b>Course Title : Agile Software Development</b>	<b>3L:0T:0P</b>	<b>3Credits</b>
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**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.

<b>Course Code:</b> <b>BTCS 711-18</b>	<b>Course Title : Agile Software Development Lab</b>	<b>L:0T:2P</b>	<b>Credits:1</b>
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**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 Ethereum 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 Metrics:** Laws governing performance measurements. Metrics - 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.

<b>BTCS 716-18</b>	<b>Adhoc and Wireless Sensor Networks</b>	<b>L:03, T:0, P: 0</b>	<b>Credits: 3</b>
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**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 Moraes 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](http://www.wirelessnetworksonline.com)
2. [www.securityinwireless.com](http://www.securityinwireless.com)
3. [www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf](http://www.ida.liu.se/~petel71/SN/lecture-notes/sn.pdf) Practice Aspects 1. NS2 Simulator tool

<b>BTCS 717-18</b>	<b>Adhoc and Wireless Sensor Networks Lab</b>	<b>L:0, T:0, P: 2</b>	<b>Credits: 1</b>
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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. David Mermin
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.

# 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
<b>Total Minimum credits</b>			<b>15</b>	

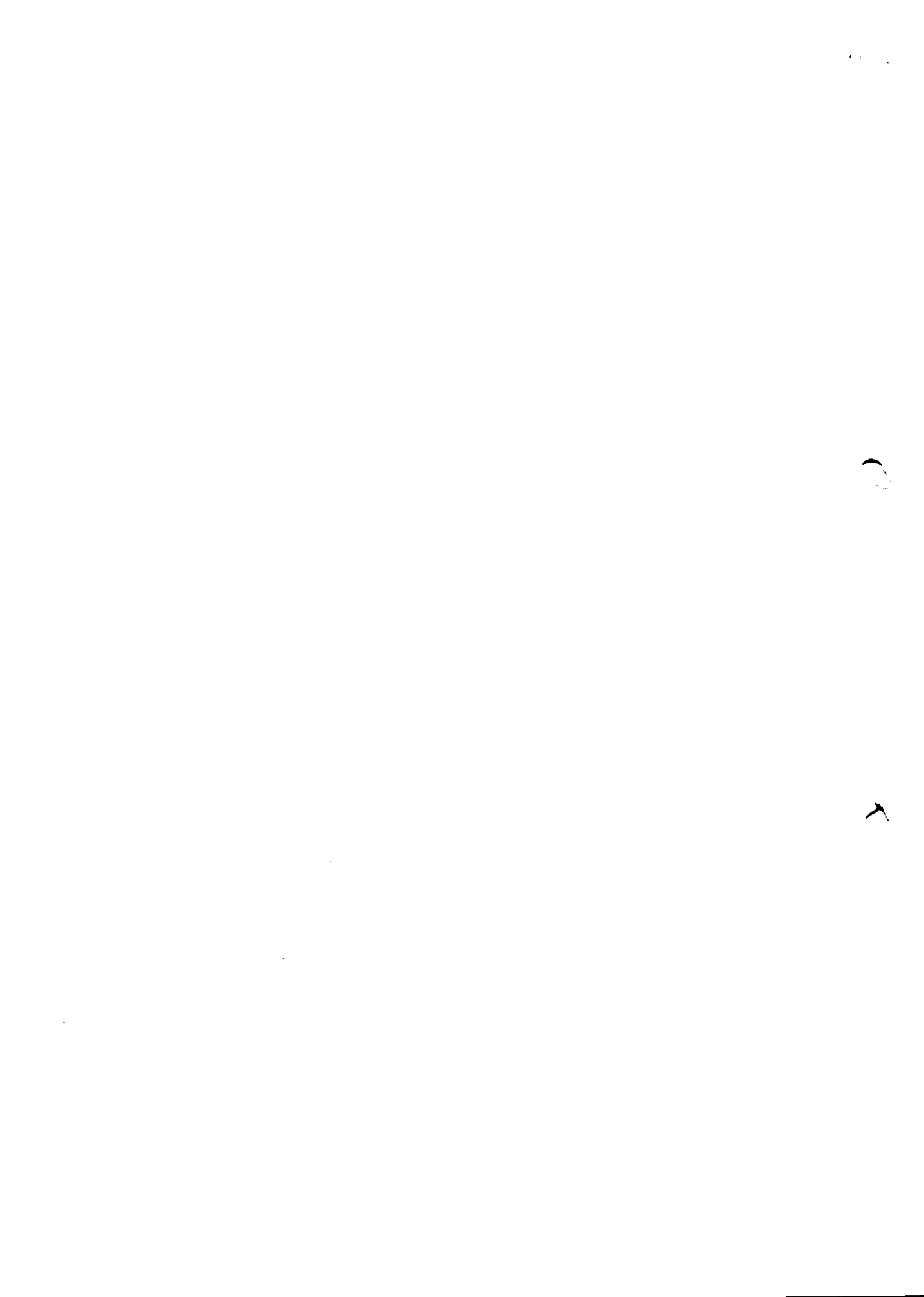
-Scd-  
Registrar

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

Registrar





**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
<b>Total Minimum credits</b>			<b>15</b>	

*Prin. Dr.*

*Sanjay Mehta*

*Dr. S. K. Saha*

### 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.

*Prasad*

*Saran Mair*

*Halper*

## 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.

*Principles*  
*Ramay Maini*  
*Kate*

**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. Geoffrey 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.

*Prakash*      *Daman Main*  
*Sharma*

**Pre Ph.D. Course in Computer Science and Engineering  
Data Warehousing and Data Mining**

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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, star 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

*Handwritten signatures:*  
Jinshu  
Damon Mavis  
Dachu

**Pre Ph.D. Course in Computer Science and Engineering  
Mobile Computing Technologies**

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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 Vaighi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

*Prinshu*

*Samy Nair*

*Kalra*



**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 ciphers. 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.

*Praveen*      *Daman Maini*      *Kalish*

**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 8<sup>th</sup> 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.

*Prakash*

*Darshan Main*

*Sahu*

**Pre Ph.D. Course in Computer Science and Engineering**  
**Advanced Computer Architecture**

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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.

*Jain*

*Daman Mains*

*Kalra*

**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Database Systems**

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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, Hamiltonian Paths & 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, Boyer-Moore.
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 Cormen, "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.

*Janaki*      *Laura Mai*      *Subu*

**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Operating Systems**

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1. Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lamport'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. Operating Systems Concepts & design-Milan Milenkovic, TMH
2. Operating System- H.M. Deitel, Pearsons.
3. Advanced Concepts in operating Systems-Mukesh Singhal and Niranjan G. 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.

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**Pre Ph.D. Course in Computer Science and Engineering  
Big Data Analytics**

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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.

*Sanjay* *Raman Mair* *Kob*



## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Advanced Data Communication

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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, 3rd ed., 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, 8<sup>th</sup> ed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2<sup>nd</sup> Edition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2<sup>nd</sup> ed., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4<sup>th</sup> ed., Wiley-Interscience, John Wiley & Sons, 2004.

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## 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 – 2<sup>nd</sup> Edition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

*Janku*

*Jayant Mani*

## 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. Pronsens, 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.

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**Inter Disciplinary course**

**Pre Ph.D. Course in Computer Science and Engineering  
Adhoc Wireless and Sensor Networks**

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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

*Jurhu.*  
*Danay Maini*  
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## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Neural Networks and Fuzzy Logic

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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-a-Box 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.

*Janak*

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*Sahu*

## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Mathematical Foundations of Computer Networks

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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]

*Final. Lauran Mair*  
*hsh*

# 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
<b>Total Minimum credits</b>			<b>15</b>	

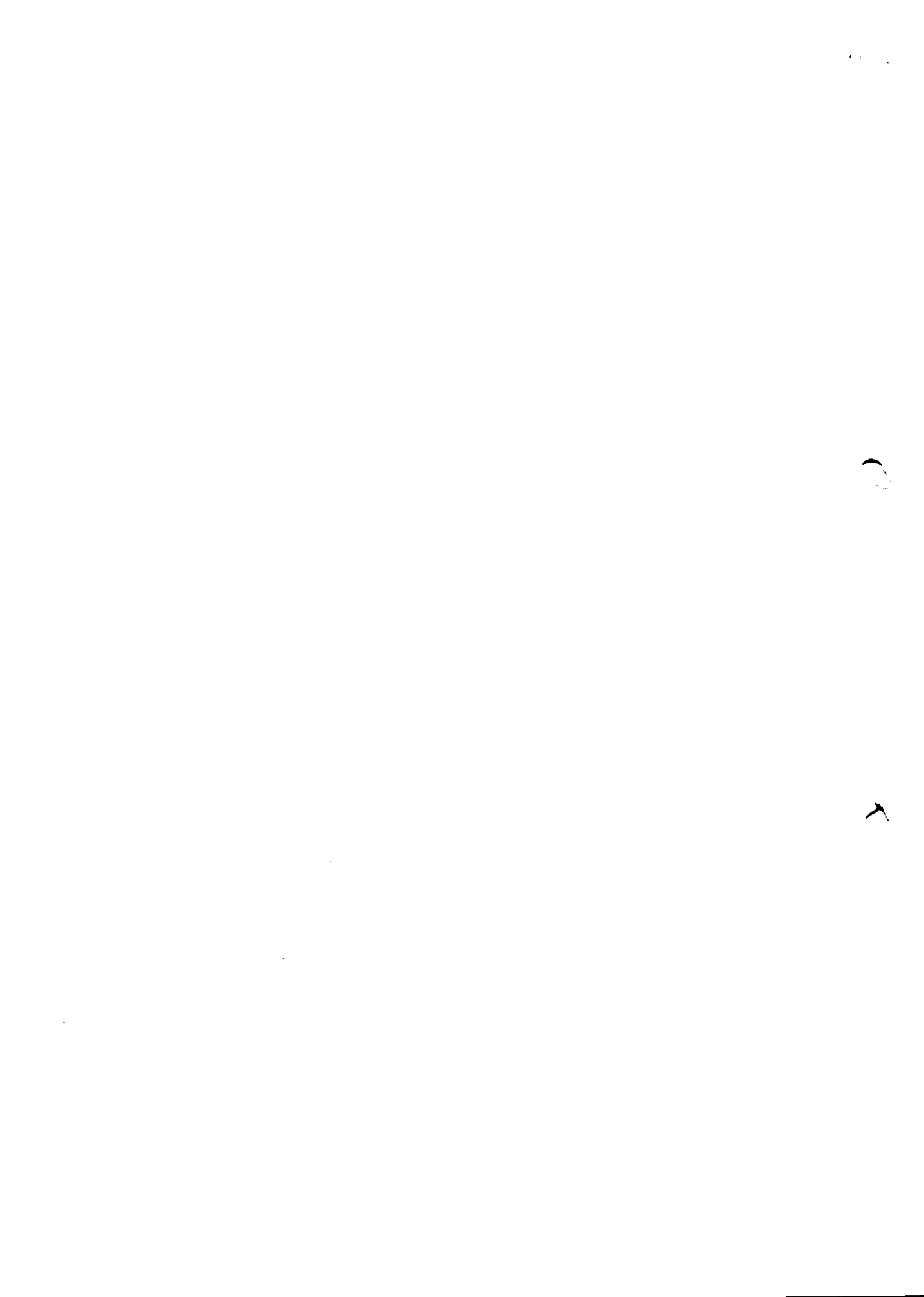
*-Sc-*  
Registrar

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

*[Signature]*  
Registrar





**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
<b>Total Minimum credits</b>			<b>15</b>	

*Prin. Dr.*

*Sanjay Mehta*

*Dr. S. K. Saha*

### 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**

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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.

*Principles*

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## Pre Ph.D. Course in Computer Science and Engineering

### Advanced Concepts in Image Processing

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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 McGraw-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

*Jain*

*Jayaraman*

*Veera*

**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Information Security**

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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.

*Principles*  
*Ramay Maini*  
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**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. Geoffrey 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.

*Prakash*      *Daman Main*  
*Sharma*

**Pre Ph.D. Course in Computer Science and Engineering**  
**Data Warehousing and Data Mining**

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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, starlet 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

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**Pre Ph.D. Course in Computer Science and Engineering  
Mobile Computing Technologies**

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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 Vaighi, Alexander Damn Jaonvic – Pearson
4. ADALESTEIN : Fundamentals of Mobile & Parvasive Computing, 2008, TMH.

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**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 ciphers. 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.

*Praveen*      *Daman Maini*      *Kalish*

**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Software Engineering**

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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 8<sup>th</sup> 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.

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**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Computer Architecture**

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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.

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**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, Hamiltonian Paths & 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, Boyer-Moore.
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 Cormen, "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**

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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.

*Janaki*      *Laura Mai*      *Subu*

**Pre Ph.D. Course in Computer Science and Engineering  
Advanced Operating Systems**

L	T	P
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1. Distributed operating system: Architectures, Issues in Distributed operating systems, Limitations of Distributed Systems, Lamport's logical clock, Global states, Chandy-Lamport'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. Operating Systems Concepts & design-Milan Milenkovic, TMH
2. Operating System- H.M. Deitel, Pearsons.
3. Advanced Concepts in operating Systems-Mukesh Singhal and Niranjan G. 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.

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**Pre Ph.D. Course in Computer Science and Engineering  
Big Data Analytics**

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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.

*Sanjay* *Raman Mair* *Kob*



## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Advanced Data Communication

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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, 3rd ed., 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, 8<sup>th</sup> ed., 2007, PHI.
5. Data Communication and Tele Processing Systems - T. Housely, 2<sup>nd</sup> Edition, 2008, BSP.
6. Data Communications and Computer Networks- Brijendra Singh, 2<sup>nd</sup> ed., 2005, PHI.
7. Telecommunication System Engineering – Roger L. Freeman, 4<sup>th</sup> ed., Wiley-Interscience, John Wiley & Sons, 2004.

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## 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 – 2<sup>nd</sup> Edition – TMH
5. High Speed Networks and Internets- William Stallings, Pearson Education, 2002.

*Jankar*

*Jayant Mani Joshi*

**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. Pronsens, 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.

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**Inter Disciplinary course**

**Pre Ph.D. Course in Computer Science and Engineering  
Adhoc Wireless and Sensor Networks**

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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

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## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Neural Networks and Fuzzy Logic

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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-a-Box 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.

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## Inter Disciplinary course

### Pre Ph.D. Course in Computer Science and Engineering Mathematical Foundations of Computer Networks

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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]

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