	K.S.R. COLLEGE OF ENGINEERING (Autonomous) (Approved by AICTE & Affiliated to Anna University) K.S.R. Kalvi Nagar, Tiruchengode- 637 215	CURRICULUM PG R - 2018

Department	Department of Computer Science and Engineering
Programme	M.E - Computer Science and Engineering

SEMESTER - I

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.	MA18133	Statistics and Operations Research	3	0	0	3	30	70	100
2.	CS18111	Advanced Data Structures	3	0	0	3	30	70	100
3.	CS18112	Research Methodology and IPR	2	0	0	2	30	70	100
4.		Professional Elective - I	3	0	0	3	30	70	100
5.		Professional Elective - II	3	0	0	3	30	70	100
PRACTICAL									
6.	CS18121	Advanced Data Structures Laboratory	0	0	3	2	50	50	100
7.	CS18122	Cloud Computing Laboratory	0	0	3	2	50	50	100
		Total	**14**	**0**	**6**	**18**	**700**		

SEMESTER - II

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.	CS18211	Advanced Algorithms	3	0	0	3	30	70	100
2.	CS18212	Soft Computing	3	0	0	3	30	70	100
3.		Professional Elective - III	3	0	0	3	30	70	100
4.		Professional Elective - IV	3	0	0	3	30	70	100
PRACTICAL									
5.	CS18221	Advanced Algorithms Laboratory	0	0	3	2	50	50	100
6.	CS18222	Big Data and Analytics Laboratory	0	0	3	2	50	50	100
7.	CS18223	Technical Presentation	0	0	3	2	50	50	100
		Total	**12**	**0**	**9**	**18**	**700**		

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Department	Department of Computer Science and Engineering
Programme	M.E - Computer Science and Engineering

SEMESTER - III

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
THEORY									
1.		Professional Elective - V	3	0	0	3	30	70	100
2.		Professional Elective - VI	3	0	0	3	30	70	100
3.		Audit course	2	0	0	0	50	50	100
PRACTICAL									
4.	CS18321	Project Phase – I	0	0	20	10	50	50	100
Total			**8**	**0**	**20**	**16**	**400**		

SEMESTER - IV

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
PRACTICAL									
1.	CS18421	Project Phase – II	0	0	32	16	50	50	100
Total			**0**	**0**	**32**	**16**	**100**		

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Department	Department of Computer Science and Engineering
Programme	M.E - Computer Science and Engineering

List of Electives

PROFESSIONAL ELECTIVES – I and II (SEMESTER – I)

Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
1.	CS18161	Machine Learning Techniques	3	0	0	3	30	70	100
2.	CS18162	Wireless Sensor Networks	3	0	0	3	30	70	100
3.	CS18163	Intelligent Systems	3	0	0	3	30	70	100
4.	CS18164	Data Science	3	0	0	3	30	70	100
5.	CS18165	Distributed Systems	3	0	0	3	30	70	100
6.	CS18166	Digital Image Processing and Pattern Recognition	3	0	0	3	30	70	100
7.	CS18167	Cloud Computing	3	0	0	3	30	70	100
8.	CS18168	Multicore Architectures	3	0	0	3	30	70	100
9.	CS18169	Advanced Database Technology	3	0	0	3	30	70	100
10.	CS18171	Advanced Wireless and Mobile Networks	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVES – III and IV (SEMESTER – II)									
Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
1.	CS18261	Data Preparation and Analysis	3	0	0	3	30	70	100
2.	CS18262	Secure Software Design and Enterprise Computing	3	0	0	3	30	70	100
3.	CS18263	Computer Vision	3	0	0	3	30	70	100
4.	CS18264	Human and Computer Interaction	3	0	0	3	30	70	100
5.	CS18265	Digital Forensics	3	0	0	3	30	70	100
6.	CS18266	Advanced Operating systems	3	0	0	3	30	70	100
7.	CS18267	Fault Tolerant Systems	3	0	0	3	30	70	100
8.	CS18268	Big Data and Analytics	3	0	0	3	30	70	100
9.	CS18269	Cognitive Science	3	0	0	3	30	70	100
10.	CS18271	Information Retrieval Techniques	3	0	0	3	30	70	100

PROFESSIONAL ELECTIVES – V and VI(SEMESTER – III)									
Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
1.	CS18361	Mobile Applications and Services	3	0	0	3	30	70	100
2.	CS18362	Compiler for high performance computing	3	0	0	3	30	70	100
3.	CS18363	Optimization Techniques	3	0	0	3	30	70	100
4.	CS18364	Internet of Things	3	0	0	3	30	70	100
5.	CS18365	Ethical Hacking	3	0	0	3	30	70	100
6.	CS18366	Web Technology	3	0	0	3	30	70	100
7.	CS18367	Cost Management of Engineering Projects	3	0	0	3	30	70	100
8.	CS18368	Information Security	3	0	0	3	30	70	100
9.	CS18369	Social Network Analysis	3	0	0	3	30	70	100
10.	CS18371	Object Oriented Software Engineering	3	0	0	3	30	70	100

AUDIT COURSE (SEMESTER – III)									
Sl.No.	Course Code	Course Name	Hours/ Week			Credit	Maximum Marks		
			L	T	P	C	CA	ES	Total
1.	CS183A1	English for Research Paper Writing	2	0	0	0	50	50	100
2.	CS183A2	Disaster Management	2	0	0	0	50	50	100
3.	CS183A3	Value Education	2	0	0	0	50	50	100
4.	CS183A4	Constitution of India	2	0	0	0	50	50	100

Total Number of Credits: 68

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SEMESTER – I

		L	T	P	C
MA18133	**STATISTICS AND OPERATIONS RESEARCH**	3	0	0	3

Objectives:

- *To acquire knowledge in finding the inference of the samples by using various methods in testing of hypothesis.*
- *To interpret variances by design of experiments to obtain inferences and to develop and solve the Linear Programming problems during the uncertain situations in the engineering fields.*
- *To enable to obtain the optimal solutions in Transportation and Assignment problems and to solve the networking problems by using PERT and critical path methods.*

UNIT – I TESTING OF HYPOTHESIS [9]

Sampling distributions – Type I and Type II errors – Test of significance for attributes: test for difference between two proportions – Test of significance for small sample (Student's t- test) – Test of significance for large samples (z-test) – Test of significance of variance (F- test) – chi-square test for Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS [9]

Analysis of variance – One-way and two-way classifications – Completely randomized design –Randomized block design – Latin square design.

UNIT – III LINEAR PROGRAMMING [9]

Formation of LPP – Graphical method – Simplex method – Big M Method – Dual Simplex Method.

UNIT – IV TRANSPORTATION AND ASSIGNMENT PROBLEMS [9]

Transportation Models (Minimizing and Maximizing Problems) – Balanced and unbalanced Problems – Initial Basic feasible solution by N-W Corner Rule, Least cost and Vogel's approximation methods – Optimum solution by MODI Method – Assignment Models (Minimizing and Maximizing Problems) – Balanced and Unbalanced Problems – Travelling Salesman problem.

UNIT – V PERT/CPM [9]

Network Construction – Critical Path Method – Computation of earliest start time, latest start time, Total, free and independent float time – PERT –Computation of optimistic, most likely Pessimistic and expected time–Crashing.

Total =45 Periods

Course Outcomes:

Upon Completion of the course, the students should be able to :

- *Find the inference of the samples by using various methods in testing of hypothesis.*
- *Interpret variances by design of experiments to obtain inferences.*
- *Develop the linear programming concepts during the uncertain situations in the engineering fields.*
- *Obtain the optimal solutions in transportation and assignment problems.*
- *Solve the networking problems by using PERT and critical path methods.*

Reference Books :

1 Dr. S.P. Gupta," Statistical Methods", Sultan Chand and Sons, New Delhi, 2013.

2 P.K.Gupta& Man Mohan,"Operations Research" Sultan Chand & Sons, 12th edition, 2013.

3 Gupta, S. C. and Kapoor, V. K., Fundamentals of Mathematical Statistics, Sultan Chand and Sons, New Delhi, 2014.

4 Taha, H.A., "Operations Research: An Introduction", Pearson Education, New Delhi, 2015.

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SEMESTER – I

		L	T	P	C
CS18111	**ADVANCED DATA STRUCTURES**	3	0	0	3

Objectives:

- *To choose appropriate data structures, understand the ADT/libraries, and use it to design algorithms for a specific problem.*
- *To study the necessary mathematical abstraction to solve problems.*
- *To familiarize students with advanced paradigms and data structure used to solve algorithmic problems.*
- *To analyze the efficiency and proofs of correctness.*

UNIT – I DICTIONARIES AND HASHING [9]

Dictionaries: Definition – Dictionary Abstract Data Type – Implementation of Dictionaries. Hashing: Review of Hashing – Hash Function – Collision Resolution Techniques in Hashing – Separate Chaining – Open Addressing, Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing.

UNIT – II SKIP LISTS [9]

Skip Lists: Need for Randomizing Data Structures and Algorithms – Search and Update Operations on Skip Lists – Probabilistic Analysis of Skip Lists – Deterministic Skip Lists.

UNIT – III TREES [9]

Trees: Binary Search Trees – AVL Trees – Red Black Trees – 2-3 Trees – B-Trees–Splay Trees.

UNIT – IV TEXT PROCESSING [9]

Text Processing: Sting Operations – Brute-Force Pattern Matching – The Boyer-Moore Algorithm – The Knuth-Morris-Pratt Algorithm – Standard Tries – Compressed Tries – Suffix Tries – The Huffman Coding Algorithm – The Longest Common Subsequence Problem (LCS) – Applying Dynamic Programming to the LCS Problem.

UNIT – V COMPUTATIONAL GEOMETRY [9]

Computational Geometry: One Dimensional Range Searching – Two Dimensional Range Searching – Constructing a Priority Search Tree – Searching a Priority Search Tree – Priority Range Trees – Quad trees – k-d Trees.

Total =45 Periods

Course Outcomes:

Upon Completion of the course, the students should be able to :

- *Implement the symbol table using hashing techniques.*
- *Summarize the concept of skip lists.*
- *Develop and analyze algorithms for red-black trees, B-trees and Splay trees.*
- *Design algorithms for text processing applications.*
- *Identify suitable data structures and develop algorithms for computational geometry problems.*

Reference Books :

1 Mark Allen Weiss, "Data Structures and Algorithm Analysis in C++", 4th Edition, Pearson, 2014.

2 M T Goodrich, Roberto Tamassia, "Algorithm Design", John Wiley, 2002.

3 Alfred V. Aho and John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006.

4 Robert Sedgewick and Kevin Wayne, 'Algorithms", Pearson Education, 4thEdition, 2010.

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SEMESTER – I

		L	T	P	C
CS18112	**RESEARCH METHODOLOGY AND IPR**	2	0	0	2

Objectives:

- *To learn the basics of research problem, effective technical writing and developing a research proposal.*
- *To study about Nature of Intellectual Property and Patent Rights.*

UNIT – I BASCIS OF RESEARCH PROBLEM [6]

Meaning of research problem – Sources of research problem – Criteria Characteristics of a good research problem – Errors in selecting a research problem – Scope and objectives of research problem. Approaches of investigation of solutions for research problem – Data collection – Analysis – Interpretation – Necessary instrumentations.

UNIT – II TECHNICAL WRITING AND PROPOSAL [6]

Effective literature studies approaches – Analysis Plagiarism – Research ethics – Effective technical writing – How to write Report – Paper – Developing Research Proposal – Format of research proposal – Presentation and Assessment by a review committee.

UNIT – III INTELLECTUAL PROPERTY [6]

Nature of Intellectual Property: Patents – Designs –Trade and Copyright. Process of Patenting and Development: Technological research – Innovation – Patenting – Development. International Scenario: International cooperation on Intellectual Property – Procedure for grants of patents – Patenting under PCT.

UNIT – IV PATENT RIGHTS [6]

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

UNIT – V DEVELOPMENTS IN IPR [6]

New Developments in IPR: Administration of Patent System – New developments in IPR – IPR of Biological Systems – Computer Software – Traditional knowledge Case Studies – IPR and IITs.

Total = 30 Periods

Course Outcomes:

Upon Completion of the course, the students should be able to :

- *Examineresearch problem formulation.*
- *Analyze research related information.*
- *Follow research ethics.*
- *Utilize the* Patent information and databases
- *Emphasis the need of information about Intellectual Property Right to be promoted among students in general and engineering in particular.*

Reference Books :

1 Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction",Juta and Company Ltd, 2nd Edition 2004.

2 Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners", 2014.

3 Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction", 2004.

4 Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students", 1996.

5 Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.

6 Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.

7 T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

8 Stuart Melville and Wayne Goddard, "Research methodology: anintroduction for science & engineering students",Juta and Company Ltd,1996.

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SEMESTER – I

		L	T	P	C
CS18121	**ADVANCED DATA STRUCTURES LABORATORY**	0	0	3	2

Objectives:

- *To acquire the knowledge of various hashing techniques.*
- *To learn the usage of advanced trees.*
- *To know the usage of pattern matching techniques*

LIST OF EXPERIMENTS:

1. Implementation of Merge Sort and Quick Sort Analysis.
2. Implementation of Separate Chaining in hashing.
3. Implementation of Linear Probing in hashing.
4. Implementation of Binary Search Tree.
5. Implementation of AVL Tree.
6. Implementation of Red-Black Tree.
7. Implementation of Splay tree.
8. Implementation of various string operations.
9. Implementation of Matrix Chain Multiplication.
10. Implementation of Activity Selection and Huffman Coding.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

- *Implement basic sorting algorithms.*
- *Design various searching techniques.*
- *Construct advanced tree structures.*
- *Analyze the* various *string operations*
- *Evaluation of compression techniques*

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SEMESTER – I

		L	T	P	C
CS18122	**CLOUD COMPUTING LABORATORY**	0	0	3	2

Objectives:

- *To know the installation of hypervisors.*
- *To learn the installation of different cloud simulation tools and cloud setup tools.*
- *To deploy cloud services.*

LIST OF EXPERIMENTS:

1. a) Installation of various hypervisors and instantiation of VMs with image file using open source hypervisors such as Virtual Box, VMWare Player, Xen and KVM.
   b) Client server communication between two virtual machine instances, execution of chat application.
2. Creation of simple network topology using open source network virtualization tools (like mini net and others).
3. Implementation of simple network protocols using open source network controllers (like Open Daylight).
4. Implementation of various scheduling mechanisms using open source cloud simulator.
5. Familiarization and usage of the following cloud services with open source cloud tools(like Eucalyptus, Open stack, Open Nebula and others)
   a) Scheduling mechanisms
   b) Load balancing mechanisms
   c) Hashing and encryption mechanisms
6. Familiarization and usage of collaborative applications (SaaS).
7. Implementing applications using Google App Engine (PaaS).
8. Develop MapReduce application (example-URL Pattern count and others) using Hadoop cluster set up (Single node and multi node).

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

- Install the various hypervisors and VMs
- *Run their application on the instantiated VMs over different hypervisors.*
- *Simulate their sample proposed systems.*
- *Setup a private cloud with open source cloud tools and deploy simple cloud services.*
- *Develop MapReduceapplication using Hadoopsetup.*

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SEMESTER – II

		L	T	P	C
CS18211	**ADVANCED ALGORITHMS**	3	0	0	3

Objectives:

- *To impart the studentswith various advanced methods of designing and analyzing algorithms.*
- *To choose appropriate algorithms and use it for a specific problem.*
- *To familiarize students with basic paradigms and data structures used to solve advanced algorithmic problems.*
- *To learn different classes of problems concerning their computation difficulties.*
- *To demonstrate recent developments in the area of algorithmic design*

UNIT – I SORTING AND GRAPH [9]

Sorting: Review of various sorting algorithms – Topological sorting. Graph: Definitions and Elementary Algorithms – Shortest path by BFS – Shortest path in edge-weighted case (Dijkstra's) – Depth-first search and computation of strongly connected component – Emphasis on correctness proof of the algorithm and time/space analysis.

UNIT – II MATROIDS AND GRAPH MATCHING [9]

Matroids: Introduction to greedy paradigm – Algorithm to compute a maximum weight maximal independent set – Application to MST. Graph Matching: Algorithm to compute maximum matching – Characterization of maximum matching by augmenting paths – Edmond's Blossom algorithm to compute augmenting path.

UNIT – III FLOW-NETWORKS AND MATRIX COMPUTATIONS [9]

Flow-Networks: Maxflow-mincut theorem – Ford-Fulkerson Method to compute maximum flow – Edmond-Karp maximum-flow algorithm. Matrix Computations: Strassen's algorithm and Divide and Conquer paradigm – Inverse of a triangular matrix – Relation between the time complexities of basic matrix operations – LUP-Decomposition.

UNIT – IV GRAPHS, POLYNOMIALS AND DISCRETE FOURIER TRANSFORM [9]

Shortest Path in Graphs: Floyd-Warshall algorithm and dynamic programming paradigm. More Modulo Representation of integers/polynomials: Chinese Remainder Theorem – Conversion between base-representation and modulo-representation – Extension to polynomials. Application: Interpolation problem – Discrete Fourier Transform (DFT): In complex field – DFT in modulo ring – Fast Fourier Transform algorithm – Schonhage-Strassen Integer Multiplication algorithm.

UNIT – V LINEAR PROGRAMMING [9]

Linear Programming: Geometry of the feasibility region and Simplex algorithm – NP-completeness: Examples – proof of NP-hardness and NP-completeness – Approximation algorithms – Randomized Algorithms.

Total =45 Periods

Course Outcomes:

Upon Completion of the course, the students should be able to :

- *Analyze the complexity/performance of different algorithms.*
- *Determine the appropriate data structure for solving a particular set of problems.*
- *Categorize the different problems in various classes according to their complexity.*
- *Have an insight of recent activities in the field of the advanced data structure.*
- *Evaluate the linear programming of different algorithms*

Reference Books :

1 Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", MIT Press, 3rd Edition, 2009.

2 Aho, Hopcroft, Ullman "The Design and Analysis of Computer Algorithms",Kaifa Book Company, 1985.

3 Kleinberg and Tardos, "Algorithm Design", Pearson Education, 2006.

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SEMESTER– II

		L	T	P	C
CS18212	**SOFT COMPUTING**	3	0	0	3

Objectives:

- *To learn the key aspects of soft computing and neural networks.*
- *To study the fuzzy logic components.*
- *To know about the components and building block hypothesis of genetic algorithm.*
- *To gain knowledge in machine learning through support vector machines.*

UNIT – I BASICS OF SOFT COMPUTING [9]

Evolution of Computing – Soft Computing Constituents – From Conventional AI to Computational Intelligence – Machine Learning Basics

UNIT – II GENETIC ALGORITHMS [9]

Introduction to Genetic Algorithms (GA) – Applications of GA – Building Block Hypothesis – Representation – Fitness Measures – Genetic Operators – GA Based Machine Learning.

UNIT – III NEURAL NETWORKS [9]

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.

UNIT – IV FUZZY LOGIC [9]

Fuzzy Sets – Operations on Fuzzy Sets – Fuzzy Relations – Membership Functions – Fuzzy Rules and Fuzzy Reasoning – Fuzzy Inference Systems – Fuzzy Expert Systems – Fuzzy Decision Making

UNIT – V NEURO-FUZZY MODELING [9]

Adaptive Neuro-Fuzzy Inference Systems – Coactive Neuro-Fuzzy Modeling – Classification and Regression Trees – Data Clustering Algorithms – Rule Based Structure Identification – Neuro-Fuzzy Control – Case Studies.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Outline the concepts of soft computing.*
- *Discuss on machine learning through neural networks.*
- *Apply knowledge in developing a Fuzzy expert system.*
- *Model Neuro Fuzzy system for clustering and classification.*
- *Discover knowledge to develop Genetic Algorithm and Support vector machine based machine learning system.*

Reference Books :

1 S.N.Sivanandam and S.N.Deepa, “Introduction to Genetic Algorithms”, Springer, 2008.

2 KwangH.Lee, “First course on Fuzzy Theory and Applications”, Springer, 2005.

3 James A. Freeman and David M. Skapura, “Neural Networks Algorithms, Applications, and Programming Techniques”, Addison Wesley, 2003.

4 Mitchell Melanie, “An Introduction to Genetic Algorithm”, MIT Press, 1996.

5 Jyh-Shing Roger Jang, Chuen-Tsai Sun, EijiMizutani, “Neuro-Fuzzy and Soft Computing”, Prentice-Hall of ndia, 2002.

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SEMESTER – II

		L	T	P	C
CS18221	**ADVANCED ALGORITHMS LABORATORY**	0	0	3	2

Objectives:

- *To study various sorting and searching algorithms.*
- *To learn the different graph traversal methods.*
- *To study the various shortest path algorithms.*

LIST OF EXPERIMENTS:

1. Write a menu based program for sorting algorithms.
2. Write a menu based program for searching algorithms.
3. Write a menu driven program to perform DFS andBFS.
4. Implementation of Prim's algorithm to find minimum cost spanning tree.
5. Implementation of Dijkstra's algorithm.
6. Implementation of Warshall's Algorithm.
7. Implementation of the extended Euclidean algorithm.
8. Implementation of the Modular exponentiation technique on an input data set.
9. Implementation of matrix multiplication Algorithm.
10. Implementation of Matrix Chain Multiplication.

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

- *Summarizethe different sorting and searching algorithms.*
- *Implement the various graph traversal methods.*
- *Analyze the different shortest path algorithm*
- *Demonstrate the extended Euclidean algorithm and modular exponentiation techniques.*
- *Implement Strassen'smatrix multiplication and matrix chain multiplication algorithms.*

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SEMESTER – II

		L	T	P	C
CS18222	**BIG DATA AND ANALYTICS LABORATORY**	0	0	3	2

Objectives:

- *To learn setting up of Hadoop Cluster*
- *To solve Big Data problems using MapReduce Technique.*

LIST OF EXPERIMENTS:

1. Set up a pseudo-distributed, single-node Hadoop cluster backed by the Hadoop Distributed File System, running on Ubuntu Linux. After successful installation on one node, configuration of a multi-node Hadoop cluster (one master and multiple slaves).
2. MapReduce application for word counting on Hadoop cluster
3. Unstructured data into NoSQL data and do all operations such as NoSQL query with API.
4. K-means clustering using MapReduce.
5. Page Rank Computation.
6. Mahout machine learning library to facilitate the knowledge build up in big data analysis.
7. Application of Recommendation Systems using Hadoop/mahout libraries

Total : 45 Periods

Course Outcomes: On Completion of this course , the student will be able to

- *Set up multi-node hadoop clusters*
- *Apply* MapReduce*algorithms for various algorithms.*
- *Design a new algorithm that uses*MapReduce*to apply on unstructured and structured data.*
- *Demonstrate the page rank Computation.*
- *Facilitate the knowledge build up in big data analysis using Mahout Machine learning library.*

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SEMESTER – II

		L	T	P	C
CS18223	**TECHNICAL PRESENTATION**	0	0	3	2

Objectives:

- *To prepare students to gain confidence in technical presentation and report preparation.*

Guidelines:

1. The students have to refer the journals, conference proceedings which are published recently.
2. By mutual discussions with the faculty, the student can choose a topic in specific area.
3. The student has to submit a technical report having 30 - 50 pages to the corresponding faculty one week before the final presentation.

Total : 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Refer and utilize various technical resources available from multiple fields.*
- *Analyze the importance of intonation, word and sentence stress for improving communicative*
- *Competence, identifying and overcoming problem sounds.*
- *Interact and share their technical knowledge to enhance the leadership skills.*
- *Prepare report and present oral demonstrations.*

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18161	**MACHINE LEARNING TECHNIQUES**	3	0	0	3

Objectives:

- *To learn the concepts of machine learning and aspects of computational learning theory*
- *To gain supervised and unsupervised learning and their applications.*
- *To study the theoretical and practical aspects of probabilistic graphical models.*

UNIT–I BASICS OF MACHINE LEARNING [9]

Machine Learning – Machine Learning Foundations – Overview – Design of a Learning System – Types of Machine learning – Applications Mathematical foundations of Machine Learning – Random Variables and Probabilities – Probability Theory – Probability Distributions – Decision Theory – Bayes Decision Theory – Information Theory.

UNIT –II SUPERVISED LEARNING [9]

Linear Models for Regression – Linear Models for Classification – Naive Bayes – Discriminant Functions – Probabilistic Generative Models – Probabilistic Discriminative Models – Bayesian Logistic Regression – Decision Trees – Classification Trees – Regression Trees – Pruning – Neural Networks – Feed Forward Network Functions – Back-Propagation – Support vector machines – Ensemble methods – Bagging – Boosting.

UNIT – III UNSUPERVISED LEARNING [9]

Clustering – K means – EM Algorithm – Mixtures of Gaussians–Curse of Dimensionality – Dimensionality Reduction – Factor Analysis – Principal Component Analysis – Probabilistic PCA.

UNIT ––IV PROBABILISTIC GRAPHICAL MODELS [9]

Graphical Models – Undirected Graphical Models – Markov Random Fields – Directed Graphical Models – Bayesian Networks – Conditional Independence Properties – Inference – Generalization – Hidden Markov Models.

UNIT – V ADVANCED LEARNING [9]

Sampling – Basic Sampling methods – Monte Carlo. Reinforcement Learning – K-Armed Bandit – Elements – Model-Based Learning – Value Iteration – Policy Iteration –Temporal Difference Learning – Exploration Strategies.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Design a neural network for an application of your choice.*
- *Implement probabilistic discriminative and generative algorithms for an application of your choice and analyze the results.*
- *Use a tool to implement typical clustering algorithms for different types of applications.*
- *Design and implement an HMM for a sequence model type of application.*
- *Identify applications suitable for different types of machine learning with suitable justification.*

Reference Books :

1 EthemAlpaydin, “Introduction to Machine Learning”, MIT Press, Third Edition, 2014.

2 Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012

3 Trevor Hastie, Robert Tibshirani and Jerome Friedman, “The Elements of Statistical Learning”, Springer, Second Edition, 2011.

4 Christopher Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18162	**WIRELESS SENSOR NETWORKS**	3	0	0	3

Objectives:

- *To architect sensor networks for various application setups.*
- *To devise appropriate data dissemination protocols and model links cost.*
- *To study the fundamental concepts of wireless sensor networksand have a basicknowledge of the various protocols at various layers.*
- *To evaluate the performance of sensor networks and identify bottlenecks.*

UNIT – I BASICS OF WIRELESS SENSOR NETWORKS [9]

Introduction: Wireless Sensor Networks – Motivations – Applications – Performance metrics – History and Design factors. Network Architecture: Traditional layered stack – Cross-layer designs – Sensor Network Architecture. Hardware Platforms: Motes – Hardware parameters.

UNIT – II NS-3 [9]

Introduction to Ns-3 – Introduction to Network Simulator 3 (Ns-3) – Description of the Ns-3 core module and simulation example.

UNIT– III MEDIUM ACCESS CONTROL PROTOCOL DESIGN AND ANALYSIS [9]

Medium Access Control Protocol design: Fixed Access – Random Access – WSN protocols: synchronized – duty-cycled. Markov Chain: Discrete time Markov Chain definition – Properties – Classification and analysis MAC Protocol Analysis: Asynchronous duty-cycled – X-MAC Analysis (Markov Chain).

UNIT –IV SECURITY [9]

Security: Possible attacks – Countermeasures – SPINS – Static and dynamic key distribution.

UNIT – V ROUTING PROTOCOLS [9]

Routing protocols: Introduction – MANET protocols. Routing protocols for WSN: Resource-aware routing – Data centric-Geographic Routing – Broadcast – Multicast. Opportunistic Routing Analysis: Analysis of opportunistic routing (Markov Chain).

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Describe and explain radio standards and communication protocols for wireless sensor networks.*
- *Explain the function of the node architecture and use of sensors for various applications.*
- *Be familiar with architectures, functions and performance of wireless sensor networks systems and platforms.*
- *Evaluate the various security mechanisms for wireless sensor networks.*
- *Analyze the different routing protocols for wireless sensor networks*

Reference Books :

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

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18163	**INTELLIGENT SYSTEMS**	3	0	0	3

Objectives:

- *To introduce 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.*
- *To explore the essential theory behind methodologies for developing systems that demonstrate intelligent behavior including dealing with uncertainty,learning from experience and following problem solving strategies found in nature.*

UNIT – I BIOLOGICAL FOUNDATIONS TO INTELLIGENT SYSTEMS – I [9]

Biological foundations to intelligent systems I: Artificial neural networks –Back propagation networks – Radial basis function networks -- Recurrent networks.

UNIT – II BIOLOGICAL FOUNDATIONS TO INTELLIGENT SYSTEMS – II [9]

Biological foundations to intelligent systems II: Fuzzy logic – Knowledge Representation and inference mechanism – Genetic algorithm – Fuzzy neural networks.

UNIT – III SEARCH METHODS [9]

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.

UNIT – IV KNOWLEDGE REPRESENTATION AND LOGICAL INFERENCE [9]

Knowledge representation and logical inference – Issues in knowledge representation – Structured representation: frames, scripts, semantic networks and conceptual graphs. Formal logic and logical inference – Knowledge-based systems structures – Basic components – Ideas of Blackboard architectures.

UNIT – V UNCERTAINTY AND LEARNING TECHNIQUES [9]

Reasoning under uncertainty and Learning Techniques on uncertainty reasoning: Bayesian reasoning – Certainty factors and Dempster-Shafer – Theory of Evidential reasoning – Study of different learning and Evolutionary algorithms – Statistical learning and Induction learning.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Demonstrate knowledge of the fundamental principles of intelligent systems.*
- *Compare the relative merits of a variety of AI problem solving techniques.*
- *Analyze the various search methods for intelligent systems.*
- *Examine idea of knowledge representation and logical inference.*
- *Evaluatethe concepts of reasoning under uncertainty and learning techniques on uncertainty reasoning*

Reference Books :

1 Luger G.F. and Stubblefield W.A. “Artificial Intelligence: Structures and strategies for Complex Problem Solving”, Addison Wesley, 6th Edition, 2008.

2 Russell S. and Norvig P. “Artificial Intelligence: A Modern Approach”. Prentice-Hall, 3rd Edition, 2009.

3 CrinaGrosan, Ajith Abraham, “Intelligent Systems: A Modern Approach”, Springer Science & Business Media, 2011.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18164	**DATA SCIENCE**	3	0	0	3

Objectives:

- *To provide the knowledge and expertise to become a proficient data scientist.*
- *To study statistics and machine learning concepts that is vital for data science.*
- *To evaluate data visualizations based on their design and use for communicating stories from data.*

UNIT – I BASICS OF DATA SCIENCE [9]

Introduction to core concepts and technologies: Introduction –Terminology – Data science process –Data science toolkit – Types of data –Example applications.

UNIT – II DATA COLLECTION AND MANAGEMENT [9]

Data collection and management: Introduction – Sources of data – Data collection and APIs – Exploring and fixing data – Data storage and management – Using multiple data sources.

UNIT – III DATA ANALYSIS [9]

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.

UNIT – IV DATA VISUALISATION [9]

Data Visualisation: Introduction – Types of data visualization – Data for Visualisation: Data types – Data encodings – Retinal variables – Mapping variables to encodings –Visual encodings.

UNIT – V APPLICATIONS [9]

Applications of Data Science – Technologies for visualization – Recent trends in various data collection and analysis techniques – Various visualization techniques.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Summarize the core concepts and technologies of data science.*
- *Explain how data is collected, managed and stored for data science.*
- *Analyzethe data and some basic machine learning algorithms.*
- *Outline the key concepts in data science, including their real-world applications and the toolkit used by data scientists*
- *Implement data collection and management scripts using MongoDB*

Reference Books :

1 Cathy O'Neil and Rachel Schutt, "Doing Data Science", Straight Talk from The Frontline. O'Reilly, 2013.

2 Jure Leskovek, AnandRajaraman and Jeffrey Ullman, "Mining of Massive Datasets v2.1", Cambridge University Press, 2nd Edition, 2014.

3 Field Cady, "The Data Science Handbook", John Wiley & Sons, 2017.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18165	**DISTRIBUTED SYSTEMS**	3	0	0	3

Objective:

- *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.*

UNIT – I FUNDAMENTALS OF DISTRIBUTED SYSTEMS [9]

Introduction: Distributed data processing – 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.

UNIT – II DATABASE DESIGN AND ISSUES [9]

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.

UNIT – III QUERY OPTIMIZATION AND TRANSACTION MANAGEMENT [9]

Distributed Query Optimization: Factors governing query optimization – Centralized query optimization – Ordering of fragment queries – Distributed query optimization algorithms. Transaction Management: Transaction concept – Goals of transaction management – Characteristics of transactions – Taxonomy of transaction models.

UNIT – IV CONCURRENCY CONTROL AND RELIABILITY [9]

Concurrency Control: Concurrency control in centralized database systems – Concurrency control in DDBSs –Distributed concurrency control algorithms – Deadlock management. Reliability: Reliability issues in DDBS – Types of failures – Reliability techniques – Commit protocols – Recovery protocols.

UNIT – V PARALLEL DATABASE SYSTEMS [9]

Parallel Database Systems: Parallel architectures – Parallel query processing and optimization – Load balancing. Mobile Databases – Distributed Object Management –Multi-databases.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Design trends in distributed systems.*
- *Utilize network virtualization concepts.*
- *Apply remote method invocation techniques.*
- *Outline the concepts of concurrency control in centralized database systems and reliability*
- *Analyze the concepts of parallel database systems and mobile database.*

Reference Books :

1 M.T. Ozsu and P. Valduriez, “Principles of Distributed Database Systems”, Prentice-Hall, 2011.

2 D. Bell and J. Grimson, “Distributed Database Systems”, Addison-Wesley, 1992.

3 George Colouris, Jean Dollimore and Tim Kinberg, “Distributed system concept and Design” Pearson Education, 4th Edition, 2012.

4 SunitaMahajan and Seema Shah, “Distributed Computing”, Oxford Higher Education, 2010.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18166	**DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION**	3	0	0	3

Objectives:

- *To study the basic concepts and algorithms of digital image processing.*
- *To familiarize with the image processing environments like MATLAB and its equivalent open source Image processing environments.*
- *To expose the students to a broad range of image processing techniques and issues and their applications and to provide the student with practical experiences using them.*
- *To learn the usage of image processing in current technologies.*

UNIT – I FUNDAMENTALS OF IMAGE PROCESSING **[9]**

Introduction – Elements of Visual Perception, Steps in Image Processing Systems – Digital Imaging System – Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – Colour Images and Models – Image Operations – Arithmetic, Logical, Statistical and Spatial Operations.

UNIT – II IMAGE ENHANCEMENT AND RESTORATION **[9]**

Image Transforms – Discrete and Fast Fourier Transform and Discrete Cosine Transform – Spatial Domain – Gray level Transformations – Histogram Processing – Spatial Filtering: Smoothing and Sharpening – Frequency Domain: Filtering in Frequency Domain – Smoothing and Sharpening Filters – Homomorphic Filtering – Noise models – Constrained and Unconstrained Restoration Models.

UNIT – III IMAGE SEGMENTATION AND MORPHOLOGY **[9]**

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation – Image Morphology: Binary and Gray level Morphology Operations – Erosion, Dilation, Opening and Closing Operations – Distance Transforms – Basic Morphological Algorithms.

UNIT – IV PATTERN RECOGNITION **[9]**

Component Labeling – Image Features – Textures – Boundary Representations and Descriptions – Regional Descriptors – Feature Selection and Feature Dimensionality Reduction – Image Classification and Recognition –Statistical Classifiers – Clustering Algorithms – Hierarchical and Partitional Clustering.

UNIT – V IMAGE PATTERN RECOGNITION CASE STUDIES **[9]**

Image Understanding – Case Studies in Biometrics – Video Processing – Image Fusion – Image Security – Steganography and Watermarking.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Implement basic image processing algorithms using MATLAB tool.*
- *Design an application that incorporates different concepts of Image processing.*
- *Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression and wavelet processing and image morphology.*
- *Critically analyze different approaches to implement mini projects.*
- *Explore the possibility of Applying image processing concepts in various domains.*

Reference Books :

1 S.Sridhar, “Digital Image Processing”, Oxford University Press, New Delhi, 2011.

2 Rafael C.Gonzalez and Richard E.Woods, “Digital Image Processing”, Third Edition, Pearson Education, New Delhi, 2008.

3 Alasdair McAndrew, “Introduction to Digital Image Processing with Matlab”, Cengage Learning, India, 2011.

4 Anil J Jain, “Fundamentals of Digital Image Processing”, PHI, 2011.

5 Wilhelm Burger and Mark J Berge, “Digital Image Processing: An algorithmic Introduction using Java”, Springer International Edition, 2008.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18167	**CLOUD COMPUTING**	3	0	0	3

Objectives:

- *To learn how to apply trust-based security model to real-world security problems.*
- *To study the concepts, processes and best practices needed to successfully secure information within Cloud infrastructures.*
- *To know the basic Cloud types and delivery models and develop an understanding of the risk and compliance responsibilities and challenges for each Cloud type and service delivery model.*

UNIT – I BASICS OF CLOUD COMPUTING [9]

Online Social Networks and Applications – Cloud introduction and overview –Different clouds – Risks – Novel applications of cloud computing–Cloud Computing Architecture: Requirements – Introduction Cloud computing architecture –On Demand Computing Virtualization at the infrastructure level –Security in Cloud computing environments – CPU Virtualization –Hypervisors Storage Virtualization Cloud Computing Defined –SPI Framework for Cloud Computing –Traditional Software Model– Cloud Services Delivery Model.

UNIT – II CLOUD DEPLOYMENT MODELS AND SECURITY ISSUES [9]

Key Drivers to Adopting the Cloud – The Impact of Cloud Computing on Users –Governance in the Cloud – Barriers to Cloud Computing Adoption In the Enterprise. Infrastructure Security: The Network Level – The Host Level – The Application Level – Data Security and Storage – Aspects of Data Security – Data Security Mitigation Provider Data and Its Security.

UNIT – III ACCESS AND SECURITY MANAGEMENT [9]

Identity and Access Management: Trust Boundaries and IAM – IAM Challenges – Relevant IAM Standards and Protocols for Cloud Services – IAM Practices in the Cloud – Cloud Authorization Management. Security Management in the Cloud: Security Management Standards – Security Management in the Cloud – Availability Management: SaaS, PaaS, IaaS.

UNIT – IV PRIVACY ISSUES [9]

Privacy Issues – Data Life Cycle – Key Privacy Concerns in the Cloud – Protecting Privacy – Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing – Legal and Regulatory Implications – U.S. Laws and Regulations – International Laws and Regulations.

UNIT – V AUDIT AND COMPLIANCE [9]

Internal Policy Compliance – Governance – Risk and Compliance (GRC) –Regulatory/External Compliance – Cloud Security Alliance – Auditing the Cloud for Compliance – Security-as-a-Cloud.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Identify security aspects of each cloud model.*
- *Develop a risk-management strategy for moving to the cloud.*
- *Implement a public cloud instance using a public cloud service provider.*
- *Apply trust based security model to different layer.*
- *Examine the concept of audit and compliance.*

Reference Books :

1 John Rhoton, “Cloud Computing Explained: Implementation Handbook for Enterprises”, 2009.

2 Tim Mather, “Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)”, O’Reilly Media, 2009.

3 RajkumarBuyya, Christian Vecchiola, and ThamaraiSelvi, “Mastering Cloud Computing”, Tata McGraw Hill, 2013

4 Tom White, "Hadoop: The Definitive Guide", Yahoo Press, 2012

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18168	**MULTI CORE ARCHITECTURES**	3	0	0	3

Objectives:

- *To introduce the recent trends in the field of computer architecture and identify performance related parameters.*
- *To study the different multiprocessor issues.*
- *To expose the different types of multicore architectures.*
- *To learn the design of the memory hierarchy.*

UNIT – I FUNDAMENTALS OF COMPUTER DESIGN AND ILP [9]

Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges – Limitations of ILP – Multithreading – SMT and CMP Architectures – The Multicore era.

UNIT – II MEMORY HIERARCHY DESIGN [9]

Introduction – Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines – Design of Memory Hierarchies – Case Studies.

UNIT – III MULTIPROCESSOR ISSUES [9]

Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization Issues – Models of Memory Consistency – Interconnection Networks – Buses, Crossbar and Multi-Stage Interconnection Networks.

UNIT – IV MULTICORE ARCHITECTURES [9]

Homogeneous and Heterogeneous Multi–core Architectures – Intel Multicore Architectures – SUN CMP Architecture – IBM Cell Architecture -- Introduction to Warehouse -- Scale Computers, Cloud Computing – Architectures and Issues – Case Studies.

UNIT – V VECTOR AND GPU ARCHITECTURES [9]

Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPGPU Computing – Detecting and Enhancing Loop Level Parallelism.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Identify the limitations of ILP and the need for multicore architectures.*
- *Discuss the issues related to multiprocessing and suggest solutions.*
- *Point out the salient features of different multicore architectures and how they exploit parallelism.*
- *Critically analyze the different types of inter connection networks.*
- *Design a memory hierarchy and optimize it.*

Reference Books :

1 John L. Hennessey and David A. Patterson, “Computer Architecture – A Quantitative Approach”, Morgan Kaufmann / Elsevier, Fifth edition, 2012.

2 Darryl Gove, “Multicore Application Programming: For Windows, Linux, and Oracle Solaris”, Pearson, 2011.

3 David B. Kirk, Wen-mei W. Hwu, “Programming Massively Parallel Processors”, Morgan Kauffman, 2010.

4 Wen–mei W. Hwu, “GPU Computing Gems”, Morgan Kaufmann / Elsevier, 2011.

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SEMESTER – I(ELECTIVE)

CS18169	**ADVANCED DATABASE TECHNOLOGY**	L	T	P	C
		3	0	0	3

Objectives:

- *To know the underlying principles of relational database management system.*
- *To learn and implement the advanced features of DBMS.*
- *To develop database models using distributed databases.*
- *To implement and maintain an efficient database system using emerging trends.*

UNIT– I RELATIONAL MODEL [9]

Data Model – Types of Data Models: Entity Relationship Model – Relational Data Model – Mapping Entity Relationship Model to Relational Model – Structured Query Language – Database Normalization – Transaction Management.

UNIT– II PARALLEL AND DISTRIBUTED DATABASES [9]

Centralized and Client-Server Architectures – Parallel Systems – Distributed Systems – Parallel Databases – I/O Parallelism – Inter and Intra Query Parallelism – Inter and Intra Operation Parallelism – Distributed Database Concepts: Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing.

UNIT– III XML DATABASES [9]

XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.

UNIT– IV MULTIMEDIA DATABASES [9]

Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.

UNIT– V CURRENT ISSUES [9]

Active Databases – Deductive Databases – Data Warehousing – Data Mining – Database Tuning – Database Security.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Design relational databases.*
- *Implement parallel and distributed databases.*
- *Analyzethe concept of XML databases and multimedia databases.*
- *Demonstrate the concept of database connectivity with the applications.*
- *Summarize the concepts of current issues.*

Reference Books :

1 R. Elmasri and S.B. Navathe, “Fundamentals of Database Systems”, Addison-Wesley, 2011.

2 Thomas Cannolly and Carolyn Begg, “Database Systems, A Practical Approach to Design, Implementation and Management”, Third Edition, Pearson Education, 2007.

3 Henry F Korth, Abraham Silberschatz and S. Sudharshan, “Database System Concepts”, 5th Edition, McGraw Hill, 2006.

4 C.J.Date, A.Kannan and S.Swamynathan, “An Introduction to Database Systems”, Pearson Education, 8th Edition 2006.

5 V.S.Subramanian, “Principles of Multimedia Database Systems”, Harcourt India Pvt. Ltd., 2001.

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SEMESTER – I(ELECTIVE)

		L	T	P	C
CS18171	**ADVANCED WIRELESS AND MOBILENETWORKS**	3	0	0	3

Objectives:

- *To study the wireless/mobile market and the future needs.*
- *To get familiar with key concepts of wireless networks, standards, technologies and their basic operations.*
- *To learn how to design and analyses various medium access.*
- *To study how to evaluate MAC and network protocols using network simulation software tools.*

UNIT – I BASICS OF WIRELESS NETWORKS [9]

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. Wireless Local Area Networks: IEEE 802.11 Wireless LANs Physical & MAC layer – 802.11 MAC Modes (DCF& PCF) IEEE 802.11 standards – Architecture and protocols – Infrastructure VsAdhoc Modes – Hidden Node and Exposed Terminal Problem – Fading Effects in Indoor and outdoor WLANs – WLAN Deployment issues.

UNIT – II WIRELESS CELLULAR NETWORKS [9]

Wireless Cellular Networks: 1G and 2G – 2.5G – 3G and 4G – Mobile IPv4 – Mobile IPv6 – TCP over Wireless Networks –Cellular architecture – Frequency reuse – Channel assignment strategies – Handoff strategies – Interference and system capacity – Improving coverage and capacity in cellular systems – Spread spectrum Technologies.

UNIT – III WIRELESS SENSOR NETWORKS [9]

WiMAX (Physical layer, Media access control, Mobility and Networking) – IEEE 802.22Wireless Regional Area Networks – IEEE 802.21 Media Independent Handover Overview. Wireless Sensor Networks: Introduction – Application – Physical – MAC layer and Network Layer – Power Management – Tiny OS Overview.

UNIT – IV WIRELESS PANs AND SECURITY [9]

Wireless PANs: Bluetooth and Zigbee – Introduction to Wireless Sensors. Security: Security in wireless Networks Vulnerabilities – Security techniques – Wi-Fi Security – DoS in wireless communication.

UNIT – V ADVANCED TOPICS [9]

IEEE 802.11x and IEEE 802.11i standards – Introduction to Vehicular Adhoc Networks.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Demonstrate advanced knowledge of networking and wireless networking.*
- *Design WLAN, WPAN, WWAN and cellular based upon underlying propagation and performance analysis.*
- *Analyze protocols used in wireless networks and learn simulating wireless networks.*
- *Constructwireless networks exploring trade-offs between wire line and wireless links.*
- *Develop mobile applications to solve some of the real world problems.*

Reference Books :

1 Schiller J., “Mobile Communications”, Addison Wesley 2008.

2 Stallings W., “Wireless Communications and Networks”, Pearson Education 2009.

3 Stojmenic Ivan, “Handbook of Wireless Networks and Mobile Computing”, John Wiley and SonsInc 2002.

4 Yi Bing Lin and ImrichChlamtac, “Wireless and Mobile Network Architectures”, John Wiley andSonsInc 2000.

5 Pandya Raj, “Mobile and Personal Communications Systems and Services”, PHI 2004.

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18261	**DATA PREPARATION AND ANALYSIS**	3	0	0	3

Objective:

- *To prepare the data for analysis and develop meaningful Data Visualizations.*

UNIT – I DATA GATHERING AND PREPARATION [9]

Data formats – parsing and transformation – Scalability and real-time issues.

UNIT – II DATA CLEANING [9]

Consistency checking – Heterogeneous and missing data – Data Transformation and segmentation.

UNIT – III EXPLORATORY ANALYSIS [9]

Descriptive and comparative statistics – Clustering and association – Hypothesis generation.

UNIT –IV VISUALIZATION [9]

Designing visualizations – Time series – Geo located data – Correlations and connections – Hierarchies and networks – interactivity

UNIT– V STATISTICS [9]

Descriptive statistics – Inferential statistics – Comparative statistics

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Outline the basics of data gathering and preparation.*
- *Examine how the data cleaning is used in the data processing.*
- *Extract the data for performing the Analysis.*
- *Designing visualisation and Hierarchies and networks.*
- *Summarizethe different statistics techniques for problem solving.*

Reference Books :

1 Glenn J. Myatt, "Making sense of Data: A practical Guide to Exploratory Data Analysis and Data Mining", John Wiley & Sons, Inc, 2nd Edition 2014.

2 Donald J. Wheeler, "Making Sense of Data", SPC Press, 2003.

3 Dorian Pyle, "Data Preparation for Data Mining", Morgan Kaufmann, 1999

4 Gerhard Svolba, "Data Preparation for Analytics Using SAS", SAS Institute, 2006.

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SEMESTER – II (ELECTIVE)

CS18262	**SECURE SOFTWARE DESIGN AND ENTERPRISE COMPUTING**	L	T	P	C
		3	0	0	3

Objectives:

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

UNIT – I SECURE SOFTWARE DESIGN [9]

Software vulnerabilities and Software security analysis – Master security programming practices – Master fundamental software security design concepts – Security testing and quality assurance.

UNIT –II ENTERPRISE APPLICATION DEVELOPMENT [9]

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.

UNIT – III ENTERPRISE SYSTEMS ADMINISTRATION [9]

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).

UNIT –IV ENTERPRISE NETWORK [9]

Obtain the ability to manage and troubleshoot a network running multiple services – Understand the requirements of an enterprise network – Handle insecure exceptions and command/SQL injection – Defend web and mobile applications against attackers – Software containing minimum vulnerabilities and flaws.

UNIT– V CASE STUDY [9]

Case study of DNS server – DHCP configuration and SQL injection attack.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Differentiate between various software vulnerabilities.*
- *Software process vulnerabilities for an organization.*
- *Monitor resources consumption in a software.*
- *Interrelate security and software development process.*
- *Summarizethe case study of various attacks.*

Reference Books :

1 Theodor Richardson, Charles N Thies, “Secure Software Design”, Jones & Bartlett, 2012.

2 Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, “Enterprise Software Security”, Addison-Wesley Professional, 2014

3 RaimundasMatulevicius,“Fundamentals of Secure System Modelling”, Springer, 2017.

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SEMESTER – II (ELECTIVE)

CS18263	**COMPUTER VISION**	L	T	P	C
		3	0	0	3

Objectives:

- *To be familiar with both the theoretical and practical aspects of computing with images.*
- *To have described the foundation of image formation, measurement, and analysis.*
- *To study the geometric relationships between 2D images and the 3D world.*
- *To Grasp the principles of state-of-the-art deep neural networks*

UNIT – I OVERVIEW OF COMPUTER VISION [9]

Overview – Computer imaging systems – Lenses – Image formation and sensing – Image analysis – pre-processing and Binary image analysis.

UNIT – II DETECTION AND PERFORMANCE [9]

Edge detection – Edge detection performance – Hough transform – Corner detection.

UNIT – III SEGMENTATION [9]

Segmentation – Morphological filtering – Fourier transforms.

UNIT – IV FEATURE EXTRACTION AND PREPROCESSING [9]

Feature extraction – Shape – Histogram – Color – Spectral – Texture – CVIP tools – Feature analysis – Feature vectors – Distance /similarity measures – Data preprocessing.

UNIT – V PATTERN ANALYSIS AND CLASSIFICATION [9]

Pattern Analysis: Clustering: K-Means – K-Medoids and Mixture of Gaussians. Classification: Discriminant Function – Supervised – Un-supervised – Semi supervised Classifiers: Bayes – KNN – ANN model – Dimensionality Reduction: PCA – LDA – ICA and Non-parametric methods.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Developed the practical skills necessary to build computer vision applications.*
- *Gained exposure to object and scene recognition and categorization from images.*
- *Analysis the detection and performance of computer vision.*
- *Know the concept of feature extraction and preprocessing.*
- *Outline the various pattern analysis and classification techniques.*

Reference Books :

1 Richard Szeliski, “Computer Vision: Algorithms and Applications”, Springer London, 2010.

2 Goodfellow, Bengio, and Courville, “Deep Learning”, MIT Press, 2016.

3 Fisher et al., “Dictionary of Computer Vision and Image Processing”, John Wiley & Sons, 2013.

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18264	**HUMAN AND COMPUTER INTERACTION**	3	0	0	3

Objectives:

- *To learn the foundations of Human Computer Interaction.*
- *To be familiar with the design technologies for individuals and persons with disabilities.*
- *To be aware of mobile Human Computer interaction.*
- *To appreciate the emergence of cloud as the next generation computing paradigm.*
- *To learn the guidelines for user interface.*

UNIT – I BASICS OF HUMAN AND COMPUTER [9]

Human: I/O channels – Memory – Reasoning and problem solving; computer: Devices – Memory – Processing and networks. Interaction: Models– Frameworks – Ergonomics – Styles – Elements – Interactivity-Paradigms

UNIT – II INTERACTIVE DESIGN BASICS AND RULES [9]

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 and Rules. Evaluation Techniques – Universal Design

UNIT –III COGNITIVE MODELS [9]

Cognitive models – Socio-Organizational issues and stake holder requirements – Communication and collaboration models–Hypertext – Multimedia and WWW.

UNIT – IV MOBILE ECOSYSTEM AND APPLICATIONS [9]

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.

UNIT –V WEB INTERFACES [9]

Designing Web Interfaces – Drag and Drop – Direct Selection – Contextual Tools – Overlays – Inlays and Virtual Pages – Process Flow.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Summarize the structure of models, human computer interaction and vision.*
- *Know the interactive design basics and rules.*
- *Outline the* communication and collaboration models.
- Analysis the platforms and application frameworks for mobile eco systems.
- *Design an interactive web interface on the basis of models studied.*

Reference Books :

1 Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rdEdition, Pearson Education, 2004 (UNIT I , II & III)

2 Brian Fling, "Mobile Design and Development", 1stEdition , O'Reilly Media Inc., 2009 (UNIT –IV)

3 Bill Scott and Theresa Neil, "Designing Web Interfaces", 1stEdition, O'Reilly, 2009.(UNIT-V)

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18265	**DIGITAL FORENSICS**	3	0	0	3

Objectives:

- *To provides an in-depth study of the rapidly changing and fascinating field of computer forensics.*
- *To combines both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes.*
- *To knowledge on digital forensics legislations, digital crime, forensics processes and procedures, data acquisition and validation, e-discovery tools*
- *To E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics.*

UNIT – I BASICS OF DIGITAL FORENSICS [9]

Digital Forensics Science: Forensics science – Computer forensics and digital forensics. Computer Crime: Criminalistics as it relates to the investigative process – Analysis of cyber-criminalistics area – Holistic approach to cyber-forensics.

UNIT – II CYBER CRIME SCENE ANALYSIS [9]

Cyber Crime Scene Analysis: Court orders and 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.

UNIT – III EVIDENCE MANAGEMENT AND PRESENTATION [9]

Evidence Management and Presentation: Create and manage shared folders using operating system – Importance of the forensic mindset – Define the workload of law enforcement – Explain what the normal case would look like – Define who should be notified of a crime – Parts of gathering evidence – Define and apply probable cause.

UNIT – IV COMPUTER AND NETWORK FORENSICS [9]

Computer Forensics: Prepare a case – Begin an investigation – Understand computer forensics workstations and software – Conduct an investigation –Complete a case – Critique a case – Network Forensics: Open-source security tools for network forensic analysis – Requirements for preservation of network data.

UNIT – V MOBILE FORENSICS [9]

Mobile Forensics: Mobile forensics techniques – Mobile forensics tools. Legal Aspects of Digital Forensics: IT Act 2000 – Amendment of IT Act 2008.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Identify relevant legislation and codes of ethics*
- *Computer forensics and digital detective and various processes, policies and procedures*
- *E-discovery, guidelines and standards, E-evidence, tools and environment.*
- *Email and web forensics and network forensics Identify applications suitable for different types of machine learning with suitable justification.*
- *Analyze the concepts of mobile forensics.*

Reference Books :

1 John Sammons, "The Basics of Digital Forensics", Elsevier, John Sammons, 2014.

2 John Vacca, "Computer Forensics: Computer Crime Scene Investigation", Laxmi Publications, 3rd Edition, 2010.

3 Eoghan Casey, "Handbook of Digital Forensics and Investigation", Academic Press, 2009.

4 Eoghan Casey, "Digital Evidence and Computer Crime: Forensic Science, Computers, and the Internet", Academic Press, 2011.

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SEMESTER – II (ELECTIVE)

		L	T	P	C
CS18266	**ADVANCED OPERATING SYSTEMS**	3	0	0	3

Objectives:

- *To understand the concepts of distributed systems.*
- *To get an insight into the various issues and solutions in distributed operating systems.*
- *To learn about mobile and real-time operating systems.*
- *To gain knowledge on the design concepts of mainframe operating systems*

UNIT – I BASICS OF OPERATING SYSTEMS [9]

Overview – Synchronization Mechanisms – Processes and Threads – Process Deadlocks – Issues in Distributed Operating Systems – Communication Primitives – Limitations of a Distributed System.

UNIT – II DISTRIBUTED OPERATING SYSTEMS [9]

Lamport's Logical Clocks – Vector Clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized, Distributed and Hierarchical Deadlock Detection Algorithms – Agreement Protocols.

UNIT –III DISTRIBUTED RESOURCE MANAGEMENT [9]

Distributed File Systems – Design Issues – Google File System – Hadoop Distributed File System – Distributed Shared Memory – Algorithms for Implementing Distributed Shared Memory – Load Distributed Algorithms – Issues in Task Migration – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non Blocking Commit Protocol.

UNIT – IV MOBILE AND REAL TIME OPERATING SYSTEMS [9]

Basic Model of Real Time Systems – Characteristics – Applications of Real Time Systems – Real Time Task Scheduling – Handling Resource Sharing – Mobile Operating Systems – Architecture – Layers – Microkernel Design – Kernel Extensions – Processes and Threads – Memory Management – File system – Android – iOS.

UNIT – V MAINFRAME AND LINUX OPERATING SYSTEMS [9]

Mainframe – z/OS – Overview of z/OS Facilities – Virtual Storage and Other Mainframe Concepts – Workload Management – I/O and Data Management – Supervising the Execution of Work in the System – Cross-Memory Services – Characteristics of z/OS. Linux – Design Principles – Kernel Modules – Process Management – Scheduling – Memory Management – I/O Management – File System – InterProcess Communication.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Analyze the basics of operating systems.*
- *Demonstrate the various protocols of distributed operating systems.*
- *Identify the different features of mobile and real-time operating systems.*
- *Discuss the various features of mainframe operating systems.*
- *Summarize the concepts of Linux operating systems.*

Reference Books :

1 NikolayElenkov, "Android Security Internals: An In-Depth Guide to Android's Security Architecture", No Starch Press, 2014.

2 Andrew S. Tanenbaum and Herbert Bos, "Modern Operating Systems", Fourth Edition, Prentice Hall, 2014

3 Jonathan Levin, "Mac OS X and iOS Internals: To the Apple‟s Core", John Wiley & Sons, 2012.

4 Neil Smyth, "iPhone iOS 4 Development Essentials – Xcode", Payload Media, Fourth Edition, 2011.

5 MukeshSinghal, NiranjanShivaratri, "Advanced Concepts in Operating Systems – Distributed, Database and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001.

6 Rajib Mall, "Real-Time Systems: Theory and Practice", Prentice Hall, 2006.

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18267	**FAULT TOLERANT SYSTEMS**	3	0	0	3

Objectives:

- *To provide and appreciate a comprehensive view of fault tolerant systems.*
- *To expose the students to the methods of hardware fault tolerance.*
- *To study the different ways of providing information redundancy and the ways of providing software fault tolerance.*
- *To expose the students to concept of check pointing and their role in providing fault tolerance.*
- *To learn how to handle security attacks.*

UNIT – I BASICS OF FAULT TOLERANCE [9]

Fault Classification – Types of Redundancy – Basic Measures of Fault Tolerance – Hardware Fault Tolerance – The Rate of Hardware Failures – Failure Rate – Reliability and Mean Time to Failure – Canonical and Resilient Structures – Other Reliability Evaluation Techniques – Processor Level Techniques

UNIT – II INFORMATION REDUNDANCY [9]

Information Redundancy – Coding – Resilient Disk Systems – Data Replication – Voting: Hierarchical Organization – Primary-Backup Approach – Algorithm-Based Fault Tolerance, Fault Tolerant Networks: Measures of Resilience – Common Network Topologies and Their Resilience – Fault Tolerant Routing

UNIT – III SOFTWARE FAULT TOLERANCE [9]

Acceptance Tests – Single Version Fault Tolerance – N Version Programming – Recovery Block Approach – Preconditions – Post Conditions and Assertions – Exception Handling, Software Reliability Models – Fault Tolerant Remote Procedure Calls.

UNIT – IV CHECKPOINTING [9]

Introduction – Checkpoint Level – Optimal Check Pointing – An Analytical Model – Cache-Aided Rollback Error Recovery – Check Pointing in Distributed Systems – Check Pointing in Shared – Memory Systems – Check Pointing in Real – Time Systems – Case Studies: Non Stop Systems – Stratus Systems – Cassini Command and Data Subsystem.

UNIT – V FAULT DETECTION IN CRYPTOGRAPHIC SYSTEMS [9]

Security Attacks Through Fault Injection – Fault Attacks on Symmetric Key Ciphers – Fault Attacks on Asymmetric Key Ciphers – Counter Measures – Spatial and Temporal Duplication – Error Detecting Codes

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Define the traditional measures of fault tolerance.*
- *Point out the processor level fault tolerance techniques.*
- *Critically analyze the different types of RAID levels.*
- *Discuss techniques like recovery blocks and N-version programming.*
- *Identify techniques for check pointing in distributed and shared memory systems.*

Reference Books :

1 Israel Koren and Mani Krishna, “Fault Tolerant Systems”, Morgan Kaufmann, 2010

2 Martin L Shooman, “Reliability of Computer Systems and Networks: Fault Tolerance, Analysis and Design”, Willey, 2002.

3 LL Pullam, “Software Fault Tolerance Techniques and Implementation”, Artech House Computer Security Series, 2002.

4 Parag K. Lala, “Fault Tolerant and Fault Testable Hardware Design”, Prentice-Hall International, 1984.

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18268	**BIG DATA AND ANALYTICS**	3	0	0	3

Objectives:

- *To study big data analytics as the next wave for businesses looking for competitive advantage.*
- *To know the financial value of big data analytics and to explore tools and practices for working with big data.*
- *To learn how big data analytics can leverage into a key component.*
- *To learn about stream computing and the research that requires the integration of large amounts of data.*

UNIT – I BASICS OF BIG DATA [9]

Analytics – Nuances of Big Data – Value – Issues – Case for Big Data – Big Data options Team challenge – Big Data sources – Acquisition – Nuts and Bolts of Big data–Features of Big Data – Security, Compliance, Auditing and Protection – Evolution of Big Data – Best Practices for Big data Analytics – Big Data characteristics.

UNIT – II LAMBDA CALCULUS AND DATA ANALYSIS [9]

Lambda Notation for Functions – Syntax – Curried Functions – Parametric Polymorphism – Lambda Reduction – Alpha Reduction – Beta Reduction – Beta Abstraction – Extensionality Theorem – Delta Reduction – Reduction strategies – Normal forms – Church-Rosser Theorems – Pure Lambda Calculus – Constants – Arithmetic – Evolution of Analytic Scalability – Convergence – Parallel Processing systems – Map reduce – Enterprise analytic Sand baox – Analytic Data Sets – Analytic methods – Analytic tools – Cognos – Microstrategy – Pentaho.

UNIT –-III STREAM COMPUTING [9]

Introduction to Streams Concepts – Stream Data Model and Architecture – Stream Computing, Sampling Data in a stream – Filtering Streams – Counting Distinct Elements in a stream – Estimating Moments – Counting Oneness in a Window – Decaying Window – Real Time Analytics Platform(RTAP) Applications IBM Infosphere – Big Data at rest – Infosphere Streams – Data Stage – Statistical Analysis – Intelligent Scheduler – Infosphere Streams

UNIT – IV PREDICTIVE ANALYTICS AND VISUALIZATION [9]

Predictive Analytics – Supervised – Unsupervised Learning – Neural Networks – Kohonen Models – Normal – Deviations from Normal Patterns – Normal Behaviours – Expert Options – Variable Entry – Mining Frequent Itemsets – Market Based Model – Apriori Algorithm – Handling large Data sets in Main memory – Limited Pass algorithm – Counting frequent itemsets in a stream – Clustering Techniques – Hierarchical – K-Means – Clustering High Dimensional Data Visualizations – Visual Data Analysis Techniques – Interaction techniques – Systems and Applications

UNIT – V FRAMEWORKS AND APPLICATIONS [9]

IBM for Big Data – Map Reduce Framework – Hadoop – Hive – Sharding – NoSQL Databases – S3 – Hadoop Distributed File Systems – Hbase – Impala – Analyzing Big Data with twitter – Big Data for Ecommerce – Big Data for Blogs

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *UseHadoop,MapReduce framework.*
- *Suggest areas to apply big data to increase business outcome.*
- *Contextually integrate and correlate large amounts of information automatically to gain faster insights.*
- *Outline the concepts of various clustering techniques.*
- *Discuss the application of big data.*

Reference Books :

1 Colleen Mccue, “Data Mining and Predictive Analysis: Intelligence Gathering and Crime Analysis”, Elsevier, Second Edition, 2015.

2 AnandRajaraman and Jeffrey David Ullman, “Mining of Massive Datasets”, Cambridge University Press, 2014

3 Bill Franks, “Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics”, Wiley and SAS Business Series, 2012

4 Pete Warden, “Big Data Glossary”, O"Reilly, 2011.

5 Frank J Ohlhorst, “Big Data Analytics: Turning Big Data into Big Money”, Wiley and SAS Business Series, 2013.

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SEMESTER – II(ELECTIVE)

		L	T	P	C
CS18269	**COGNITIVE SCIENCE**	3	0	0	3

Objectives:

- *To learn the basics of cognitive science with focus on acquisition, representation, and use of knowledge by individual minds, brains, and machines*
- *To study the mind and intelligence, embracing psychology, artificial intelligence, neuroscience and linguistics*
- *To know the role of neuroscience in the cognitive field*

UNIT – I BASICS OF COGNITIVE SCIENCE [9]

Cognitive view – Some Fundamental Concepts – Computers in Cognitive Science – Applied Cognitive Science – Interdisciplinary Nature of Cognitive Science – Artificial Intelligence: Knowledge Representation – Nature of Artificial Intelligence – Knowledge Representation – Artificial Intelligence: Search, Control and Learning.

UNIT – II COGNITIVE PSYCHOLOGY [9]

Cognitive Psychology – Architecture of the Mind – Nature of Cognitive Psychology – A Global View of The Cognitive Architecture – Propositional Representation – Schematic Representation – Cognitive Processes, Working Memory and Attention – Acquisition of Skill – Connectionist Approach to Cognitive Architecture.

UNIT – III COGNITIVE NEUROSCIENCE [9]

Brain and Cognition Introduction to the Study of the Nervous System – Neural Representation – Neuropsychology – Computational Neuroscience – Organization of the Mind – Organization of Cognitive Systems – Strategies for Brain Mapping.

UNIT – IV LANGUAGE ACQUISITION, SEMANTICS AND PROCESSING MODELS [9]

Milestones in Acquisition – Theoretical Perspectives – Semantics and Cognitive Science – Meaning and Entailment – Reference – Sense – Cognitive and Computational Models of Semantic Processing – Information Processing Models of the MIND – Physical Symbol Systems and Language of Thought – Applying the Symbolic Paradigm – Neural Networks and Distributed Information Processing – Neural Network Models of Cognitive Processes.

UNIT – V HIGHER LEVEL COGNITION [9]

Reasoning – Decision Making – Computer Science and AI: Foundations and Robotics – New Horizons – Dynamical Systems and Situated Cognition – Challenges – Emotions and Consciousness – Physical and Social Environments – Applications.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Explain and analyze the major concepts, philosophical and theoretical perspectives, empirical findings, and historical trends in cognitive science, related to cultural diversity and living in a global community.*
- *Use cognitive science knowledge base to create their own methods for answering novel questions of either a theoretical or applied nature.*
- *Critically evaluate the work of others in the same domain.*
- *Be proficient with basic cognitive science research methods, including both theory-driven.*
- *Applied research design, data collection,analysis and interpretation.*

Reference Books :

1 José Luis Bermúdez, “Cognitive Science: An Introduction to the Science of the Mind”, Cambridge University Press, New York, 2014

2 Carolyn Panzer Sobel and Paul Li, “Cognitive Science: An Interdisciplinary Approach”, 2013

3 J. Friedenberg and G. Silverman, “Cognitive Science: An Introduction to the Study of Mind”, 2011

4 Neil Stillings, Steven E. Weisler, Christopher H. Chase and Mark H. Feinstein, “Cognitive Science: An Introduction”, 2nd Edition, MIT press, 1995.

5 Robert L. Solso, Otto H. MacLin and M. Kimberly MacLin, “Cognitive Psychology”, Pearson Education, 2007.

6 Paul Thagard, “Mind Introduction to Cognitive Science”, 2nd Edition, MIT Press, 2005.

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SEMESTER – II(ELECTIVE)

CS18271 INFORMATION RETRIEVAL TECHNIQUES

L	T	P	C
3	0	0	3

Objectives:

- *To learn the basics of information retrieval with pertinence to modeling, query operations and indexing.*
- *To get an understanding of machine learning techniques for text classification and clustering.*
- *To analyze the various applications of information retrieval giving emphasis to multimedia IR, web search.*
- *To know the concepts of digital libraries.*

UNIT – I MOTIVATION [9]

Basic Concepts – Practical Issues - Retrieval Process – Architecture – Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems – History of Web Search – Web Characteristics –The impact of the web on IR – IR Versus Web Search – Components of a Search Engine

UNIT – II MODELING [9]

Taxonomy and Characterization of IR Models – Boolean Model – Vector Model – Term Weighting – Scoring and Ranking – Language Models – Set Theoretic Models –Probabilistic Models – Algebraic Models – Structured Text Retrieval Models – Models for Browsing

UNIT – III INDEXING [9]

Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching – Sequential Searching and Pattern Matching. Query Operations – Query Languages – Query Processing – Relevance Feedback and Query Expansion – Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency

UNIT – IV CLASSIFICATION AND CLUSTERING [9]

Text Classification and Naive Bayes – Vector Space Classification – Support Vector Machines and Machine Learning on Documents. Flat Clustering – Hierarchical Clustering – Matrix Decompositions and Latent Semantic Indexing – Fusion and Meta Learning

UNIT – V SEARCHING THE WEB [9]

Searching the Web – Structure of the Web – IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis – XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Build an information retrieval system using the available tools.*
- *Identify and design the various components of an information retrieval system.*
- *Outlinethe concepts of index construction and index compression.*
- *Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval.*
- *Design an efficient search engine and analyze the web content structure.*

Reference Books :

1 Ricardo Baeza, Yates, BerthierRibeiro and Neto, “Modern Information Retrieval: The concepts and Technology behind Search (ACM Press Books)”, Second Edition, 2011.

2 Stefan Buttcher, Charles L. A. Clarke and Gordon V. Cormack, “Information Retrieval Implementing and Evaluating Search Engines”, The MIT Press, Cambridge, Massachusetts London, England, 2010.

3 Christopher D. Manning, PrabhakarRaghavan and HinrichSchutze, “Introduction to Information Retrieval”, Cambridge University Press, First South Asian Edition, 2008.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18361	**MOBILE APPLICATIONS AND SERVICES**	3	0	0	3

Objectives:

- *To know the three main mobile platforms and their ecosystems, namely Android, IOS and Phone Gap/WebOS.*
- *To explores emerging technologies and tools used to design and implement feature-rich mobile applications for smart phones and tablets*
- *It also takes into account the technical constraints relative to storage capacity, processing capacity, display screen, communication interfaces, and the user interface, context and profile.*

UNIT – I BASICS OF MOBILE APPLICATION [9]

Introduction: Mobile Computing and Android Development Environment – Factors in Developing Mobile Applications – Mobile Software Engineering – Frameworks and Tools – Generic UI Development Android User.

UNIT – II USER INTERFACES [9]

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.

UNIT – III COMMUNICATIONS VIA NETWORK AND THE WEB [9]

State Machine – Correct Communications Model – Android Networking and Web –Telephony Deciding Scope of an App – Wireless Connectivity and Mobile Apps – Android Telephony Notifications and Alarms: Performance and Memory Management – Android Notifications and Alarms – Graphics – Performance and Multithreading – Graphics and UI Performance – Android Graphics

UNIT – IV DEPLOYING AND MULTIMEDIA [9]

Packaging and Deploying – Performance Best Practices – Android Field Service App – Location Mobility and Location Based Services Android. Multimedia: Mobile Agents and Peer-to-Peer Architecture – Android Multimedia

UNIT – V ISSUES AND RECENT TRENDS [9]

Platforms and Additional Issues: Development Process – Architecture – Design –Technology Selection – Mobile App Development Hurdles – Testing – Security and Hacking – Active Transactions – More on Security – Hacking Android. Recent trends in Communication protocols for IOT nodes – Mobile computing techniques in IOT – Agents based communications in IOT.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Identify the target platform and users.*
- *Define and sketch a mobile application*
- *Summarize the fundamentals, frameworks, and development lifecycle of mobile application platforms.*
- *Design and develop a mobile application prototype in one of the platform and deploying.*
- *Be familiar with platforms and additional issues.*

Reference Books :

1 Anup Kumar, Bin Xie, “Handbook of Mobile Systems Applications and Services”, CRC Press, 2016.

2 Jeff McWherter, Scott Gowell, “Professional Mobile Application Development”, John Wiley & Sons,2012.

3 Wei-Meng Lee, “Beginning Android™ 4 Application Development”, John Wiley & Sons, 2012.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18362	**COMPILER FOR HIGH PERFORMANCE COMPUTING**	3	0	0	3

Objectives:

- *To studythe structure of compilers and high performance compiler design.*
- *To learn the concepts of cache coherence and parallel loops in compilers are included.*

UNIT – I FUNDAMENTALS OF COMPILER [9]

High Performance Systems – Structure of Compiler – Programming Language Features – Languages for High Performance.

UNIT – II DATA DEPENDENCE [9]

Data Dependence: Data Dependence in Loops – Data Dependence in Conditionals – Data Dependence in Parallel Loops – Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored Use-Def Chains – FUD Chains for Arrays – Induction Variables Using FUD Chains – Constant Propagation with FUD Chains – Data Dependence for Scalars – Data Dependence Analysis for Arrays.

UNIT – III LOOP RESTRUCTURING AND OPTIMIZING [9]

Array Region Analysis – Pointer Analysis – I/O Dependence – Procedure Calls – Inter-procedural Analysis – Loop Restructuring: Simple Transformations – Loop Fusion – Loop Fission – Loop Reversal – Loop Interchanging – Loop Skewing – Linear Loop Transformations – Strip-Mining– Loop Tiling – Optimizing for Locality: Single Reference to Each Array –Multiple References – General Tiling – Fission and Fusion for Locality.

UNIT – IV CONCURRENCY AND VECTOR ANALYSIS [9]

Concurrency Analysis: Concurrency from Sequential Loops – Concurrency from Parallel Loops – Nested Loops – Round off Error – Exceptions and Debuggers. Vector Analysis: Vector Code – Vector Code from Sequential Loops – Vector Code from For all Loops – Nested Loops – Round off Error – Exceptions and Multi-vector Computers.

UNIT – V MESSAGE PASSING AND SCALABLE SHARED MEMORY [9]

Message-Passing Machines: SIMD Machines – MIMD Machines – Data Layout – Parallel Code for Array Assignment – Remote Data Access – Automatic Data Layout – Multiple Array Assignments –Scalable Shared-Memory Machines: Global Cache Coherence – Local Cache Coherence – Latency Tolerant Machines.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Be familiar with the structure of compiler.*
- *Summarize parallel loops, data dependency, exception handling and debugging in compiler.*
- *Outline the concept of loop restructuring and optimizing.*
- *Evaluate the concurrency and vector analysis.*
- *Infer the message passing and scalable shared-memory.*

Reference Books :

1 Thomas Sterling, Matthew Anderson, MaciejBrodowicz, “High Performance Computing: Modern Systems and Practices”, Morgan Kaufmann, 2017.

2 John Levesque, Gene Wagenbreth, “High Performance Computing: Programming and Applications”, RC Press, 2010.

3 Michael Wolfe, High-Performance Compilers for Parallel Computing", Addison-Wesley,1996.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18363	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Objectives:

- *To provide insight to the mathematical formulation of real world problems.*
- *To optimize these mathematical problems using nature based algorithms it is useful especially for NP-Hard problems.*

UNIT – I FUNDAMENTALSOF OPTIMIZATION [9]

Engineering application of Optimization – Formulation of design problems as mathematical programming problems.

UNIT – II STRUCTURE OF OPTIMIZATION [9]

General Structure of Optimization Algorithms – Constraints – Feasible Region.

UNIT – III MATHEMATICAL PROGRAMMING [9]

Branches of Mathematical Programming: Optimization using calculus – Graphical Optimization – Linear Programming – Quadratic Programming – Integer Programming – Semi Definite Programming.

UNIT – IV OPTIMIZATION ALGORITHMS [9]

Optimization Algorithms like Genetic Optimization – Particle Swarm Optimization – Ant Colony Optimization.

UNIT – V RECENT TRENDS [9]

Recent trends: Applications of ant colony optimization – Applications for Particle Swarm Optimization– Genetics, linear and quadratic programming in real world applications.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Formulate optimization problems.*
- *Apply the concept of optimality criteria for various types of optimization problems.*
- *Solve various constrained and unconstrained problems in Single variable as well as multivariable.*
- *Analyzethe methods of optimization in real life situation.*
- *Be familiar with recent trends for optimization techniques.*

Reference Books :

1 Edwin K., P. Chong & Stanislaw h. Zak, “An Introduction to Optimization”, John Wiley & Sons,2013.
2 Andreas Antoniou, Wu-Sheng Lu, “Practical Optimization Algorithms and Engineering Applications”, Springer Science & Business Media,2007.
3 Dimitris Bertsimas; Robert Weismantel, “Optimization over integers”,Dynamic Ideas, 2005.
4 John K. Karlof, “Integer programming: theory and practice”, CRC Press, 2006.
5 H. Paul Williams, “Logic and Integer Programming”,Springer,2009.
6 Der-San Chen; Robert G. Batson; Yu Dang, “Applied Integer Programming: Modeling and Solution”, John Wiley and Sons, 2010.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18364	**INTERNET OF THINGS**	3	0	0	3

Objectives:

- *To gain knowledge of Internet of things architecture, web of things and its applications.*

UNIT – I BASICS OF INTERNET OF THINGS [9]

Definitions and Functional Requirements – Motivation – Architecture – Web 3.0 View of IoT– Ubiquitous IoT Applications – Four Pillars of IoT – DNA of IoT –Toolkit Approach for End-user Participation in the Internet of Things – Middleware for IoT: Overview – Communication Middleware for IoT – IoT Information Security.

UNIT – II IOT PROTOCOLS [9]

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE 802.15.4 – BAC Net Protocol– Modbus – KNX – Zigbee Architecture – Network layer – APS layer – Security.

UNIT – III WEB OF THINGS [9]

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence – Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards –Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

UNIT – IV IOT MODELS [9]

Integrated Billing Solutions in the Internet of Things – Business Models for the Internet of Things – Network Dynamics: Population Models – Information Cascades – Network Effects – Network Dynamics: Structural Models – Cascading Behavior in Networks – Small World Phenomenon.

UNIT – V APPLICATIONS OF IOT [9]

Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments – Resource Management in the Internet of Things: Clustering – Synchronization and Software Agents – Applications – Smart Grid – Electrical Vehicle Charging.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Identify and design the new models for market strategic interaction.*
- *Construct business intelligence and information security for IoT.*
- *Compare various protocols for IoT.*
- *Develop a middleware for IoT.*
- *Analyze the different models for network dynamics.*

Reference Books :

1 Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press, 2015.

2 Dieter Uckelmann, Mark Harrison and Florian Michahelles, “Architecting the Internet of Things”, Springer, 2011.

3 David Easley and Jon Kleinberg, “Networks, Crowds, and Markets: Reasoning About a Highly Connected World”, Cambridge University Press, 2010.

4 Olivier Hersent, Omar Elloumi and David Boswarthick, “The Internet of Things: Applications to the Smart Grid and Building AutomationII”, Wiley, 2012.

5 Olivier Hersent, David Boswarthick and Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18365	**ETHICAL HACKING**	3	0	0	3

Objectives:

- *To learn about the importance of information security*
- *To learn different scanning and enumeration methodologies and tools*
- *To understand various hacking techniques and attacks*
- *To be exposed to programming languages for security professionals*
- *To get familiarized with the different phases in penetration testing*

UNIT – I FUNDAMENTALS OF HACKING [9]

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Foot printing – Information Gathering Methodology – Foot printing Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range – Meta Search Engines.

UNIT – II SCANNING AND ENUMERATION [9]

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools.

UNIT – III SYSTEM HACKING [9]

Introduction – Cracking Passwords – Password Cracking Websites – Password Guessing – Password Cracking Tools – Password Cracking Counter measures – Escalating Privileges – Executing Applications – Key loggers and Spyware.

UNIT – IV PROGRAMMING FOR SECURITY PROFESSIONALS [9]

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

UNIT – V PENETRATION TESTING [9]

Introduction – Security Assessments – Types of Penetration testing – Phases of Penetration Testing – Tools –Test Tools – Penetration Testing Tools.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Defend hacking attacks and protect data assets.*
- *Defend a computer against a variety of security attacks using various tools.*
- *Practice and use safe techniques on the World Wide Web.*
- *Write the programming for security professionals.*
- *Know the different testing tools.*

Reference Books :

1 Patrick Engebretson, “The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy”, Syngress Media, Second Revised Edition, 2013.
2 Michael T. Simpson, Kent Backman and James E. Corley, “Hands-On Ethical Hacking and Network Defense”, Cengage Learning, 2012
3 Jon Erickson, Hacking: “The Art of Exploitation”, No Starch Press, Second Edition, 2008.
4 Ec-Council, “Ethical Hacking and Countermeasures: Attack Phases”, Delmar Cengage Learning, 2009

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18366	**WEB TECHNOLOGY**	3	0	0	3

Objectives:

- *To study about fundamentals, client side and server side programming, representing web data and building web applications*

UNIT – I FUNDAMENTALS OF WEB [9]

Web Essentials – Clients-Servers Communication – Markup Languages – XHTML – Simple XHTML pages style sheets – Cascading Style Sheets – Features – CSS core syntax – Style rule cascading and inheritance – Text properties – Box model – Normal flow – Beyond the normal flow – Lists – Tables –Cursor Styles.

UNIT – II CLIENT SIDE PROGRAMMING [9]

Introduction to scripting – Control statements – Functions –Operators – Arrays– Java script objects – Built-in objects – Host objects: Browsers and Document Object Model

UNIT – III SERVER SIDE PROGRAMMING [9]

Java Servlets – Servlet Architecture – Servlet Life Cycle-Parameter Data-Uniform Resource Locator Rewriting – Servlet Capabilities – Data Storage – Servlets and Concurrency –Separating Programming and presentation – ASP/JSP – JSP basics ASP/JSP objects – Simple ASP/JSP pages.

UNIT – IV REPRESENTING WEB DATA [9]

XML Documents and Vocabularies – Versions – Namespace – Document Type Definition – XML Schema –Document Object Model Based XML processing – Event Oriented Parsing: SAX (Simple API for XML) – Transforming XML Documents – Selecting XML Data: XPath – Template based Transformation XSLT

UNIT – V BUILDING WEB APPLICATIONS [9]

Introduction –Cookies – Sessions – Open Source Environment – PHP – Data type –Numbers – Strings – Arrays – Changing data type - Regular expression – Program Control –Built-in functions.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Summarize the web concepts for designing a simple web site.*
- *Demonstrate client side programming using scripts*
- *Demonstrate server side programming using ASP and JSP.*
- *Represent the web data using XML.*
- *Build web applications using open source environment.*

Reference Books :

1 Jeffrey C Jackson, “Web Technologies – A Computer Science Perspective”, Pearson Education,2012.

2 Chris Bates, “Web Programming – Building Internet Applications, “Wiley India, 2007

3 Paul J. Deital, Harvey M. Deital, “Internet and World Wide Web – How to Program” Pearson Education, 4th Edition, 2011.

4 Heather Williamson, “The Complete Reference XML” Tata McGraw Hill, 2009.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18367	**COST MANAGEMENT OF ENGINEERING PROJECTS**	3	0	0	3

Objectives:

- *To study the overview of the strategic cost management process and forecasting techniques*

UNIT – I **OVERVIEW OF THE STRATEGIC COST MANAGEMENT PROCESS** **[9]**

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.

UNIT – II **PROJECT EXECUTION AND COMMISSIONING** **[9]**

Project: Meaning – Different types – Manage – Various stages of project execution: conception to commissioning – Project execution as conglomeration of technical and nontechnical 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 and Project cost control– Project commissioning: mechanical and process.

UNIT –III **COST BEHAVIOR AND PROFIT ANALYSIS** **[9]**

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.

UNIT – IV **PLANNING AND BUDGETARY CONTROL** **[9]**

Material Requirement Planning – Enterprise Resource Planning – Total Quality Management and Theory of constraints – Activity-BasedCost Management– Bench Marking – Balanced Score Card and Value-Chain Analysis – Budgetary Control – Flexible Budgets – Performance budgets – Zero-based budgets–Measurement of Divisional profitabilitypricing decisions including transfer pricing.

UNIT –V **QUANTITATIVE TECHNIQUES** **[9]**

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

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Summarize the overview of the strategic cost management process.*
- *Analyze the various stages of project execution and commissioning.*
- *Outline the cost behavior and profit planning marginal costing.*
- *Analyze the variousplanning techniques and budgetary control*
- *Discuss about Quantitative techniques for cost management.*

Reference Books :

1 harles T. Horngren, “Cost Accounting A Managerial Emphasis”, Pearson Education India, 13th Edition, 2009.
2 Ahmed Riahi-Belkaoui, “Advanced Management Accounting”, Greenwood Publishing Group, 2001
3 Robert S. Kaplan, Anthony A. Atkinson , “Advanced Management Accounting”, Prentice Hall, 1998.
4 Ashish K. Bhattacharya, “Principles & Practices of Cost Accounting”, 3rdEdition, PHI Learning Pvt. Ltd,2004.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18368	**INFORMATION SECURITY**	3	0	0	3

Objectives:

- *To know about key management, design and access control, malicious logic and intrusion detection and network security*

UNIT – I OVERVIEW OF COMPUTER SECURITY [9]

An Overview of Computer Security – Access Control Matrix – Policy – Security policies, Confidentiality policies – Integrity policies and Hybrid policies.

UNIT – II KEY MANAGEMENT [9]

Cryptography – Key management – Session and Interchange keys – Key exchange and generation – Cryptographic Key Infrastructure – Storing and Revoking Keys – Digital Signatures – Cipher Techniques.

UNIT –III DESIGN AND ACCESS CONTROL [9]

Systems: System Design Principles – Representing Identity – Access Control Mechanisms –Introduction to assurance.

UNIT – IV MALICIOUS LOGIC AND INTRUSION DETECTION [9]

Malicious Logic: Trojan Horses – Viruses – Worms – Other forms – Defenses – Vulnerability Analysis: Introduction – Penetration Studies – Classification – Framework – Auditing and Intrusion Detection.

UNIT –V SECURITY [9]

Network Security: Policy Development – Network Organization – Availability and Network Flooding – Anticipating attacks – System Security – User Security and Program Security.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Summarize the overview of the computer security.*
- *Analyze the key management techniques.*
- *Outline the system design principles and access control mechanisms.*
- *Discuss about* malicious logic and intrusion detection
- *Describeabout* network security and anticipating attacks

Reference Books :

1 Matt Bishop, SathyanarayanaS.Venkatramanayya "Introduction to Computer Security", 2nd Edition, Pearson Education, 2009
2 Mark Merkow, James Breithaupt " Information Security : Principles and Practices" 1st Edition, Pearson Education, 2007
3 Whitman, "Principles of Information Security", 2nd Edition, Pearson Education, 2011
4 William Stallings, "Cryptography and Network Security: Principles and Practices", 5th Edition, Pearson Education, 2011.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18369	**SOCIAL NETWORK ANALYSIS**	3	0	0	3

Objectives:

- *To study the concept of semantic web and related applications.*
- *To learn knowledge representation using ontology.*
- *To understand human behavior in social web and related communities.*
- *To learn visualization of social networks.*

UNIT – I SEMANTIC WEB AND SOCIAL NETWORKS [9]

Introduction to Semantic Web: Limitations of Current Web – Development of Semantic Web – Emergence of the Social Web – Social Network Analysis: Development of Social Network Analysis – Key Concepts and Measures in Network Analysis.

UNIT – II SEMANTIC TECHNOLOGY FOR SOCIAL NETWORK ANALYSIS [9]

Electronic Sources for Network Analysis: Electronic Discussion Networks, Blogs and Online communities – Web Based Networks – Ontology Based Knowledge Representation – Resource Description Framework – Web Ontology Language – Modeling and Aggregating Social Network Data: State-of-the-Art in Network Data Representation – Ontological Representation of Social Individuals – Ontological Representation of Social Relationships – Aggregating and Reasoning with Social Network Data.

UNIT –III EXTRACTION AND MINING COMMUNITIES IN WEB SOCIAL NETWORKS [9]

Detecting Communities in Social Networks – Definition of Community – Evaluating Communities – Methods for Community Detection and Mining – Applications of Community Mining Algorithms – Tools for Detecting Communities – Social Network Infrastructures and Communities – Decentralized Online Social Networks – Challenges of DOSNs – General Purpose DOSNs.

UNIT – IV PREDICTING HUMAN BEHAVIOUR AND PRIVACY ISSUES [9]

Understanding and Predicting human Behaviour for Social Communities – User Data Management, Inference and Distribution – Enabling New Human Experiences – The Technologies – Privacy in Online Social Networks – Trust in Online Environment – Trust Models Based on Subjective Logic – Trust Network Analysis – Trust Transitivity Analysis – Combining Trust and Reputation – Trust Derivation Based on Trust Comparisons.

UNIT –V VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS [9]

Graph theory – Centrality – Clustering – Node-Edge Diagrams – Matrix Representation – Visualizing Online Social Networks, Visualizing Social Networks with Matrix Based Representations – Matrix and Node Link Diagrams – Hybrid Representations – Applications – Cover Networks – Community Welfare-Collaboration networks – Co-Citation Networks.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- Develop semantic web related applications.
- Represent knowledge using ontology.
- Predict human behaviour in social web and related communities.
- Visualize social networks.
- Study the applications of social networks.

Reference Books :

1 GuandongXu, Yanchun Zhang and Lin Li, Web Mining and Social Networking – Techniques and applications, First Edition, Springer, 2011
2 BorkoFurht, Handbook of Social Network Technologies and Applications, First Edition, Springer, 2010
3 John G. Breslin, Alexander Passant and Stefan Decker, The Social Semantic Web, Springer, 2009.
4 Peter Mika, “Social Networks and the Semantic Web”, First Edition, Springer 2007
5 Dion Goh and Schubert Foo, Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008.

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SEMESTER – III(ELECTIVE)

		L	T	P	C
CS18371	**OBJECT ORIENTED SOFTWARE ENGINEERING**	3	0	0	3

Objectives:

- *To know about funda0mentals, analysis and system design, object design and implementation issues and managing change.*

UNIT – I FUNDAMENTALS OF SOFTWARE ENGINEERING [9]

System Concepts – Software Engineering Concepts: Participation and roles, Systems and models, Work products, Activities, Tasks and Resources, Functional and Nonfunctional Requirements, Notations, Methods and Methodologies – Development Activities: Requirements Elicitation, Analysis, System Design, Object Design, Implementation, Testing – Managing –Software Development: Communication, Rationale Management, Software Configuration Management, Project management, Software Life Cycle – Unified Modeling Language: An overview, Modeling Concepts – Project Organization Concepts: Project Organizations, Roles, Tasks and Work Products, Schedule – Communication: Planned, Unplanned, Communication Mechanisms.

UNIT – II ANALYSIS [9]

Requirements Elicitation – Concepts: Functional Requirements, Nonfunctional Requirements, Completeness, Consistency, Clarity, Correctness, Realism, Verifiability, Traceability Greenfield Engineering, Reengineering and Interface Engineering – Activities: Identifying Actors, Scenarios, Use cases, Refining Use Cases, Identifying Relationships among Actors and Use Cases, Identifying Initial Analysis Objects and Non Functional Requirements – Management: Negotiating Specifications with clients, Maintaining Traceability, Documenting Requirements Elicitation – Analysis Object Model –Analysis Dynamic Models

UNIT –III SYSTEM DESIGN [9]

Decomposing the system – Overview of System Design – System Design Concepts: Subsystems and classes, Services and Subsystem Interfaces, Coupling and Cohesion, Layers and Partitions, Architectural Styles – System Design Activities: Analysis Model for a Route Planning System, Identifying Design Goals, Identifying Subsystems – Addressing Design Goals: Mapping Subsystems to Processors and Components, Identifying and Storing Persistent Data, Providing Access Control, Designing the Global Control Flow, Identifying Boundary Conditions, Reviewing System Design – Managing System Design: Documenting System Design, Assigning Responsibilities, Communicating about System Design, Iterating over the System Design

UNIT – IV OBJECT DESIGN AND IMPLEMENTATION ISSUES [9]

Reusing Pattern Solutions: Reuse Concepts, Reuse Activities, Managing Reuse – Specifying Interfaces: Interface Specification Concepts, Interface Specification Activities, Managing Object Design – Mapping Models to Code: Mapping Concepts, Mapping Activities, Managing Implementation – Testing: Concepts, Activities and Management.

UNIT –V MANAGING CHANGE [9]

Rationale Management: Concepts, Activities, Management – Configuration Management: Concepts, Activities, Management – Project Management: Concepts, Activities – Software Life Cycle: IEEE 1074, Characterizing The Maturity, Life Cycle Models.

Total = 45 Periods

Course Outcomes: On Completion of this course, the student will be able to

- Summarize the fundamentals of software engineering.
- Analyze the requirements of software, object model and dynamic model .
- Outline the system design concepts
- Describe the object design and implementation issues.
- Discuss the project management concepts.

Reference Books :

1 Bernd Bruegge, Alan H Dutoit, Object-Oriented Software Engineering, 3rd Edition, PearsonEducation, 2011.
2 Craig Larman, Applying UML and Patterns, 3rd Edition, Pearson Education, 2011.
3 Stephen Schach, Software Engineering 8th Edition, McGraw-Hill, 2010.

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SEMESTER – III(AUDIT COURSE)

		L	T	P	C
CS183A1	**ENGLISH FOR RESEARCH PAPER WRITING**	3	0	0	0

Objectives:

- *To know writing skills and level of readability*
- *To learn about what to write in each section.*
- *To ensure the good quality of paper at very first-time submission*

UNIT – I PLANNING AND PREPARATION [5]

Planning and Preparation – Word Order – Breaking up long sentences – Structuring Paragraphs and Sentences – Being Concise and Removing Redundancy – Avoiding Ambiguity and Vagueness.

UNIT – II PARAPHRASING AND PLAGIARISM [5]

Clarifying Who Did What – Highlighting Your Findings – Hedging and Criticizing – Paraphrasing and Plagiarism – Sections of a Paper – Abstracts.

UNIT – III LITERATURE SURVEY [5]

Review of the Literature – Methods – Results – Discussion – Conclusions –Final Check.

UNIT – IV ABSTRACT AND LITERATURE REVIEW [5]

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.

UNIT – V RESULTS AND CONCLUSIONS [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.

Total = 25 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Be familiar with planning and preparation for paper writing.*
- *Recognize how to avoid the plagiarism.*
- *Know how to prepare for literature survey.*
- *Get skills for writing title, abstract and introduction.*
- *Summarizeskills for writing methodsresults and discussion.*

Reference Books :

1 Adrian Wallwork, “English for Writing Research Papers”, Springer New York DordrechtHeidelberg London, 2016.
2 Day R, “How to Write and Publish a Scientific Paper”, Cambridge University Press, 2011.
3 Highman N, “Handbook of Writing for the Mathematical Sciences”, SIAM. Highman’s book, 2011
4 GoldbortR, “Writing for Science”, Yale University Press, 2006.

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SEMESTER – III(AUDIT COURSE)

		L	T	P	C
CS183A2	**DISASTER MANAGEMENT**	3	0	0	0

Objectives:

- *To demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.*
- *To critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.*
- *To develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.*
- *To know the strengths and weaknesses of disaster management approaches,*

UNIT – I BASICS OF DISASTER [5]

Disaster: Definition Factors and Significance – Difference Between Hazard and Disaster – Natural and Manmade Disasters: Difference – Nature – Types and Magnitude – Repercussions of Disasters and Hazards: Economic Damage – Loss of Human and Animal Life – Destruction of Ecosystem. Natural Disasters: Earthquakes – Volcanisms – Cyclones – Tsunamis – Floods – Droughts and Famines – Landslides and Avalanches.

UNIT – II DISASTER PRONE AREAS IN INDIA [5]

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.

UNIT – III DISASTER PREPAREDNESS AND MANAGEMENT [5]

Preparedness: Monitoring of Phenomena triggering Disaster or Hazard – Evaluation of Risk: Application of Remote Sensing – Data From Meteorological and Other Agencies – Media Reports: Governmental and Community Preparedness.

UNIT – IV RISK ASSESSMENT [5]

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.

UNIT – V DISASTER MITIGATION [5]

Meaning, Concept and Strategies of Disaster Mitigation – Emerging Trends in Mitigation – Structural Mitigation and Non-Structural Mitigation – Programs of Disaster Mitigation In India.

Total = 25 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Know the types and magnitude of disasters and hazards.*
- *Get the idea of various disaster prone areas in India.*
- *Summarize the idea of preparedness and management of disaster.*
- *Analyze the various risk assessment techniques.*
- *Be familiar withthe concept of strategies of disaster mitigation.*

Reference Books :

1 R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies", New Royal book Company, 2012.
2 Sahni, PardeepEt.Al (Eds.), "Disaster Mitigation Experiences And Reflections", Prentice Hall of India, New Delhi, 2011.
3 Goel S. L.,"Disaster Administration,Management Text, Case Studies",Deep &DeepPublication Pvt. Ltd., New Delhi, 2011.

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SEMESTER – III(AUDIT COURSE)

		L	T	P	C
CS183A3	**VALUE EDUCATION**	3	0	0	0

Objectives:

- *To study value of education and self- development.*
- *To know about the importance of character.*

UNIT – I VALUES AND SELFDEVELOPMENT [5]

Values and self-development – Social values and individual attitudes – Work ethics – Indian vision of humanism – Moral and non-moral valuation – Standards and principles – Value judgments.

UNIT – II CULTIVATION OF VALUES [5]

Importance of cultivation of values – Sense of duty – Devotion – Self-reliance – Confidence –Concentration – Truthfulness – Cleanliness – Honesty – Humanity – Power of faith – National Unity –Patriotism – Love for nature – Discipline.

UNIT – III PERSONALITY DEVELOPMENT [5]

Personality and Behavior Development – Soul and Scientific attitude – Positive Thinking – Integrity and discipline – Punctuality – Love and Kindness – Avoid fault Thinking – Free from anger – Dignity of labour.

UNIT – IV BEHAVIOR DEVELOPMENT [5]

Universal brotherhood and religious tolerance – True friendship – Happiness Vs suffering – Love for truth – Aware of self-destructive habits – Association and Cooperation – Doing best for saving nature.

UNIT – V CHARACTER AND COMPETENCE [5]

Character and Competence – Holy books Vs Blind faith – Self-management and Good health – Science of reincarnation – Equality – Nonviolence – Humility – Role of Women – All religions and same message – Mind your Mind – Self-control Honesty – Studying effectively.

Total = 25 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Get the knowledge of self-development*
- *Analyze the importance of human values*
- *Develop the overall personality*
- *Infer the importance of behavior development.*
- *Know the self-management and good health*

Reference Books :

1 Y.K. Singh, "Value Education", APH Publishing,New Delhi, 2008.

2 R. P. Shukla, "Value education and human rights", Sarup& Sons, New Delhi, 1st edition, 2004.

3 Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford UniversityPress, New Delhi, 1998.

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SEMESTER – III(AUDIT COURSE)

		L	T	P	C
CS183A4	**CONSTITUTION OF INDIA**	3	0	0	0

Objectives:

- *To learn the premises informing the twin themes of liberty and freedom from a civil rights perspective.*
- *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.*
- *To know 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.*

UNIT – I HISTORY AND PHILOSOPHY [5]

History of Making of the Indian Constitution: History – Drafting Committee (Composition andWorking) – Philosophy of the Indian Constitution: Preamble – Salient Features.

UNIT – II CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES [5]

Contours of Constitutional Rights and Duties: Fundamental Rights – Right to Equality – Right to Freedom – Right against Exploitation – Right to Freedom of Religion – Cultural and Educational Rights – Right to Constitutional Remedies – Directive Principles of State Policy – Fundamental Duties.

UNIT – III ORGANS OF GOVERNANCE [5]

Organs of Governance: Parliament – Composition – Qualifications and Disqualifications – Powers and Functions – Executive – President – Governor – Council of Ministers – Judiciary, Appointment and Transfer of Judges, Qualifications – Powers and Functions.

UNIT – IV LOCAL ADMINISTRATION [5]

Local Administration: Districts Administration head: Role and Importance –Municipalities: Introduction – Mayor and role of Elected Representative – CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles – CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments)– Village level: Role of Elected and Appointed officials –Importance of grass root democracy.

UNIT – V ELECTION COMMISSION [5]

Election Commission: Election Commission: Role and Functioning – Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning – Institute and Bodies for the welfare of SC/ST/OBC and women.

Total = 25 Periods

Course Outcomes: On Completion of this course, the student will be able to

- *Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of gandhiin Indian politics.*
- *Describe the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.*
- *Identify the circumstances surrounding the foundation of the congress socialist party [CSP] under the leadership of Jawaharlal Nehru.*
- *Illustratethe eventual failure of the proposal of direct elections through adult suffrage in the indian constitution.*
- *Outlinethe passage of the hindu code bill of 1956*

Reference Books :

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 Edition, Lexis Nexis, 2014.

4 D.D. Basu, "Introduction to the Constitution of India", Lexis Nexis, 2015.

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SEMESTER – III

		L	T	P	C
CS18321	**PROJECT PHASE– I**	0	0	20	10

Objectives:

- *To prepare students to gain confidence in solving real time problems related to computer engineering.*

GUIDELINES:

- *Each student will undertake a sizeable project involving survey of literature.*
- *The student should have to develop new techniques and to implement the systems.*
- *The student should have to write the reports under the guidance of faculty members.*

Course Outcomes: On Completion of this course, the student will be able to

- *Formulate a real world problem, identify the requirement and develop the design solutions.*
- *Identify technical ideas, strategies and methodologies.*
- *Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.*
- *Test and validate through conformance of the developed prototype and analysis the cost effectiveness.*
- *Prepare report and present oral demonstrations.*

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SEMESTER – IV

		L	T	P	C
CS18421	**PROJECT PHASE– II**	0	0	32	16

Objectives:

- *To prepare students to gain confidence in solving real time problems related to computer engineering.*

GUIDELINES:

- *Each student will undertake a sizeable project involving survey of literature.*
- *The student should have to develop new techniques and to implement the systems.*
- *The student should have to write the reports under the guidance of faculty members.*

Course Outcomes: On Completion of this course, the student will be able to

- *Analyze the real world problems.*
- *Identify the requirement and develop the design solutions.*
- *Utilize the new tools, algorithms, techniques that contribute to obtain the solution of the project.*
- *Test and validate through conformance of the developed prototype and analysis the cost effectiveness.*
- *Prepare report and oral demonstrations.*