MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)
Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

Curriculum/Syllabus

Programme Code	:	**MC**
Programme Name	:	**M.E- COMPUTER SCIENCE AND ENGINEERING**
Regulation	:	**R-2021**

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Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

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Email: principal@mec.edu.in

Estd. 2000

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INSTITUTION VISION &MISSION

INSTITUTION VISION

To be a Centre of Excellence in Engineering, Technology and Management on par with International Standards.

INSTITUTION MISSION

- To prepare the students with high professional skills and ethical values
- To impart knowledge through best practices
- To instill a spirit of innovation through Training, Research and Development
- To undertake continuous assessment and remedial measures
- To achieve academic excellence through intellectual, emotional and social stimulation

INSTITUTION MOTTO

Rural upliftment through Technical Education.

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DEPARTMENT VISION & MISSION

DEPARTMENT VISION

To produce the Computer Science and Engineering students with the Innovative and Entrepreneur skills to face the challenges ahead

DEPARTMENT MISSION

- To impart knowledge in the state of art technologies in Computer Science and Engineering
- To inculcate the analytical and logical skills in the field of Computer Science and Engineering
- To produce the graduates to examine the issues and propose solutions with Ethical values

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DEPARTMENT PROGRAM EDUCATIONAL OBJECTIVES, PROGRAM OUTCOMES & PROGRAM SPECIFIC OUTCOMES

PROGRAM EDUCATIONAL OBJECTIVES

The Computer Science and Engineering Graduates should be able to

PEO1: Graduates will be able to Practice as an IT Professional in Multinational Companies

PEO2: Graduates will be able to Gain necessary skills and to pursue higher education for career growth

PEO3: Graduates will be able to Exhibit the leadership skills and ethical values in the day to day life

PROGRAM OUTCOMES

PO1 - Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 - Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3 - Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4 - Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5 - Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 - The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7 - Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 - Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11 - Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12 - Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: Graduates should be able to design and analyze the algorithms to develop an Intelligent Systems

PSO2: Graduates should be able to apply the acquired skills to provide efficient solutions for real time problems

PSO3: Graduates should be able to exhibit an understanding of System Architecture, Networking and Information Security

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MASTER OF COMPUTER SCIENCE AND ENGINEERING

REGULATION – 2021

GROUPING OF COURSES

FOUNDATION COURSE [FC]

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21CSA01	Advanced Numerical Methods	FC	5	3	2	0	4
2.	21CSA02	Applied Mathematics	FC	5	3	2	0	4
3.	21CSA03	Applied Probability And Statistics	FC	5	3	2	0	4

PROFESSIONAL CORE [PC]

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21CSB01	Advanced Data Structures and Algorithms	PC	3	3	0	0	3
2.	21CSB02	Advanced Data Structures and Algorithms Laboratory	PC	2	0	0	2	1
3.	21CSB03	Machine learning techniques	PC	3	3	0	0	3
4.	21CSB04	Machine learning techniques Laboratory	PC	2	0	0	2	1
5.	21CSB05	Cloud Computing	PC	3	3	0	0	3
6.	21CSB06	Cloud Computing Laboratory	PC	2	0	0	2	1
7.	21CSB07	Advanced operating systems	PC	3	3	0	0	3
8.	21CSB08	Image Processing and Analysis	PC	3	3	0	0	3
9.	21CSB09	Image Processing and Analysis Laboratory	PC	2	0	0	2	1
10.	21CSB10	Soft Computing	PC	3	3	0	0	3
11.	21CSB11	Research Methodology and IPR	PC	3	3	0	0	3
12.	21CSB12	Data Mining Techniques	PC	2	0	0	2	1
13.	21CSB13	Network Design and Technologies	PC	3	3	0	0	3
14.	21CSB14	Advanced Software Engineering	PC	3	3	0	0	3

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15.	21CSB15	Advanced Database Technology	PC	3	3	0	0	3
16.	21CSB16	Advanced Database Technology Laboratory	PC	2	0	0	2	1
17.	21CSB17	Big Data Analytics	PC	3	3	0	0	3

PROFESSIONAL ELECTIVES [PE]

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	21CSC01	Advanced Algorithms	PE	3	3	0	0	3
2.	21CSC02	Advanced Algorithm Laboratory	PE	2	0	0	2	1
3.	21CSC03	Web Data Mining	PE	3	3	0	0	3
4.	21CSC04	Web Analytics and Development	PE	3	3	0	0	3
5.	21CSC05	Data Storage Technologies and Networks	PE	3	3	0	0	3
6.	21CSC06	Pattern classification and Analysis	PE	3	3	0	0	3
7.	21CSC07	Mobile and Pervasive Computing	PE	3	3	0	0	3
8.	21CSC08	Ad Hoc and Wireless Sensor Networks	PE	3	3	0	0	3
9.	21CSC09	Internet of things	PE	3	3	0	0	3
10.	21CSC10	Internet of things Lab	PE	2	0	0	2	1
11.	21CSC11	Data Preparation and Analysis	PE	3	3	0	0	3
12.	21CSC12	Advanced Computer Architecture	PE	3	3	0	0	3
13.	21CSC13	Multicore Architecture	PE	3	3	0	0	3
14.	21CSC14	Wireless Sensor Networks	PE	3	3	0	0	3
15.	21CSC15	Computer Vision	PE	3	3	0	0	3

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EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	21CSD01	Technical Seminar	EEC	2	2	0	0	2
2	21CSD02	Project Phase I	EEC	12	0	0	12	6
3	21CSD03	Project Phase II	EEC	24	0	0	24	12
4	21CSD04	Value Education	AC	2	2	0	0	0
5	21CSD05	Disaster Management	AC	2	2	0	0	0
6	21CSD06	English for Research Paper Writing	AC	2	2	0	0	0
7	21CSD07	Constitution of India	AC	2	2	0	0	0

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Department	Computer Science and Engineering	
Programme	M.E	
	SEMESTER – I	

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	21CSA02	Applied Mathematics	3	2	0	4	5
2.	21CSB03	Machine Learning Techniques	3	0	0	3	3
3.	21CSB05	Cloud Computing	3	0	0	3	3
4.	21CSB11	Research Methodology and IPR	3	0	0	3	3
5.	21CSB12	Data Mining Techniques	3	0	0	3	3
6.	PE	Professional Elective I	3	0	0	3	3
PRACTICALS							
7.	21CSB04	Machine Learning Techniques Lab	0	0	2	1	2
8.	21CSB06	Cloud Computing Lab	0	0	2	1	2
		Total Credits				21	

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Department	Computer Science and Engineering	
Programme	M.E	
	SEMESTER – II	

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	21CSB08	Image Processing and Analysis	3	0	0	3	3
2.	21CSB13	Network Design and Technologies	3	0	0	3	3
3.	21CSB17	Big Data Analytics	3	0	0	3	3
4.	PE	Professional Elective II	3	0	0	3	3
5.	PE	Professional Elective III	3	0	0	3	3
PRACTICALS							
6.	21CSB09	Image Processing and Analysis	0	0	2	1	2
7.	PE	Professional Elective II Lab	0	0	2	1	2
8.	21CSD01	Technical Seminar	0	0	2	1	2
		Total Credits				18	

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Department	Computer Science and Engineering	
Programme	M.E	
	SEMESTER – III	

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	PE	Professional Elective - IV	3	0	0	3	3
2.	PE	Professional Elective - V	3	0	0	3	3
PRACTICAL							
3.	21CSD02	Project Phase - I	0	0	12	6	12
		Total Credits				**12**	

*Students going for Industrial Project/Thesis will complete these courses through MOOCs

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Department	Computer Science and Engineering	
Programme	M.E	
	SEMESTER – IV	

Sl. No.	Course Code	Course Name	Hours/week			Credit	Contact Hours
			L	T	P	C	
PRACTICAL							
1.	21CSD03	Project Phase - II	0	0	24	12	24
		Total Credits				**12**	

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21CSA01 **ADVANCED NUMERICAL METHODS**

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

1. To learn the algebraic equations this finds applications in many engineering branches.
2. To make the student acquire sound knowledge of computational techniques in solving ordinary differential equations that model engineering.
3. To solve Elliptic equations by using computational techniques
4. To introduce numerical tools for the solutions of partial differential equations that model several physical processes
5. To impart knowledge on numerical methods that will come in handy to solve numerically the problems that arise in engineering and technology.

COURSE OUTCOMES

21CSA01.CO1	Demonstrate understanding and implementation of numerical solution algorithms applied to solve algebraic equations
21CSA01.CO2	Be familiar with numerical solutions of ordinary differential equation and partial differential equations.
21CSA01.CO3	Be competent with finite difference method and finite element method.
21CSA01.CO4	Understanding the theoretical and practical aspects of the use of numerical methods. Implementing numerical methods for a variety of multidisciplinary applications. Establishing the limitations, advantages, and disadvantages of numerical methods
21CSA01.CO5	The students will have a clear perception of the power of numerical Techniques. This will also serve as a precursor for future research.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MCA01.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA01.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA01.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA01.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA01.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT I **ALGEBRAIC EQUATIONS** **9+6**

Systems of linear equations: Gauss Elimination method, pivoting techniques, Thomas algorithm for tridiagonal system – Jacobi, Gauss Seidel, SOR iteration methods - Systems of nonlinear equations: Fixed point iterations, Newton Method, Eigenvalue problems: power method, inverse power method, Faddeev – Leverrier Method

UNIT II **ORDINARY DIFFERENTIAL EQUATIONS** **9+6**

Runge Kutta Meth ods for system of IVPs, numerical stability, Adams - Bashforth multistep method, solution of stiff ODEs, shooting method, BVP: Finite difference method, orthogonal collocation method, orthogonal collocation with finite element method, galerkin finite element method.

UNIT III **FINITE DIFFERENCE METHOD FOR TIME DEPENDENT PARTIAL DIFFERENTIAL EQUATIONS** **9+6**

Parabolic equations: explicit and implicit finite difference methods, weighted average approximation - Dirichlet and Neumann conditions – Two dimensional parabolic equations – ADI method; First order hyperbolic equations – method of characteristics, different explicit and implicit methods; numerical stability analysis, method of lines – Wave equation: Explicit scheme - Stability of above schemes.

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UNIT IV **FINITE DIFFERENCE METHODS FOR ELLIPTIC EQUATIONS** **9+6**

Laplace and Poisson's equations in a rectangular region: Five point finite difference schemes, Leibmann's iterative methods, Dirichlet and Neumann conditions – Laplace equation in polar coordinates: finite difference schemes – approximation of derivatives near a curved boundary while using a square mesh.

UNIT V **FINITE ELEMENT METHOD** **9+6**

Partial differential equations – Finite element method – orthogonal collocation method, orthogonal collocation with finite element method, Galerkin finite element method.

TOTAL: L : 45 + T : 30 = 75

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	M.K. Jain , S.R.K. Iyengar, R.K. Jain	Computational Methods for Partial Differential Equations, 2nd Edition	New Age Publishers	2016
2.	S. K. Gupta	Numerical Methods for Engineers, 3rd Edition	New Age International Pvt Ltd Publishers	2015
3.	Saumyen Guha and Rajesh Srivastava	Numerical methods for Engineering and Science	Oxford Higher Education, New Delhi	2010
4.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
5.	Burden, R.L., and Faires, J.D.	Numerical Analysis –Theory and Applications	Cengage Learning, India Edition, New Delhi	2009

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21CSA02	APPLIED MATHEMATICS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES

1. To realize the use of matrix theory techniques in engineering applications and to develop for future applications.
2. To analyze and solve the fundamental problem with prescribed or free boundary conditions in simple cases
3. Demonstrate knowledge of mathematics and mechanics to construct, analyze and interpret real world problems
4. Provide a foundation and motivation for exposure to statistical ideas subsequent to the course.
5. To formulate and construct a mathematical model for a linear programming problem in real life situation

COURSE OUTCOMES

21CSA02.CO1 Explain geometrical concepts related to orthogonality and least squares solutions and perform calculations related to orthogonality.

21CSA02.CO2 The variational calculus makes access to mastering in a wide range of classical results of variational calculus. Students get up apply results in technical problem solutions

21CSA02.CO3 The students will have a basic knowledge of the main fields of mathematics and mechanics, including differential equations, elasticity theory, fluid mechanics.

21CSA02.CO4 The students will have an exposure of various distribution functions and help in acquiring skills in handling situations involving more than one variable

21CSA02.CO5 The knowledge gained on this course helps the students to do engineering optimization.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MCA02.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA02.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA02.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA02.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA02.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT I **MATRIX THEORY** 9+6

The Cholesky decomposition - Generalized Eigen vectors, Canonical basis - QR factorization - Least squares method - Singular value decomposition.

UNIT II **CALCULUS OF VARIATIONS** 9+6

Concept of variation and its properties – Euler's equation – Functional dependant on first and higher order derivatives – Functionals dependant on functions of several independent variables – Variational problems with moving boundaries – problems with constraints - Direct methods: Ritz and Kantorovich methods.

UNIT III **ONE DIMENSIONAL RANDOM VARIABLES** 9+6

Random variables - Probability function – moments – moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a Random Variable.

UNIT IV **LINEAR PROGRAMMING** 9+6

Formulation – Graphical solution – Simplex method – Two phase method - Transportation and Assignment Models.

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UNIT V **FOURIER SERIES AND EIGEN VALUE PROBLEMS** **9+6**

Fourier Trigonometric series: Periodic function as power signals – Convergence of series – Even and odd function: cosine and sine series – Non-periodic function: Extension to other intervals - Power signals: Exponential Fourier series – Parseval's theorem and power spectrum – Eigen value problems and orthogonal functions – Regular Sturm-Liouville systems – Generalized Fourier series.

TOTAL: L : 45 + T : 30 = 75

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Mital.K.V. Mohan and Chander	Optimization Methods in Operations Research and Systems Analysis, 4th Edition	New Age International Publishers	2016
2.	Stark. H., and Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014
3.	Hamdy ATaha	Operations Research, 9th Edition (Asia)	Pearson Education, Asia	2014
4.	Gupta A.S.	Calculus of Variations with Applications	Prentice Hall of India Pvt. Ltd., New Delhi	2011
5.	Richard Bronson	Matrix Operation, Schaum's outline series, 2nd Edition	McGraw Hill	2011

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21CSA03	APPLIED PROBABILITY AND STATISTICS	L	T	P	C
		3	2	0	4

COURSE OBJECTIVES

1. To introduce the basic concepts of one dimensional and two dimensional Random Variables.
2. To gain knowledge in the application of family of random variables in real life situations
3. To provide information about Correlation and Regression
4. Learn about maximum likelihood estimation, unbiased estimation and least square methods.
5. To enable the students to use the concepts of multivariate normal distribution and principle components analysis.

COURSE OUTCOMES

21CSA03.CO1	Analyze random or unpredictable experiments and investigate important features of random experiments. Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
21CSA03.CO2	Associate random variables by designing joint distributions and correlate the random variables
21CSA03.CO3	Perform and interpret correlation and regression analysis and develop correlation models to predict changes in processes and products for linear and non-linear relationships
21CSA03.CO4	Be familiar with multivariate analysis.
21CSA03.CO5	The student will able to acquire the basic concepts of Probability and Statistical techniques for solving mathematical problems which will be useful in solving Engineering problems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19MCA03.CO1	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA03.CO2	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA03.CO3	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA03.CO4	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-
19MCA03.CO5	X	X	X	-	-	-	-	-	-	-	X	X	-	X	-

UNIT I ONE DIMENSIONAL RANDOM VARIABLES 9+6

Random variables - Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Functions of a Random Variable.

UNIT II TWO DIMENSIONAL RANDOM VARIABLES 9+6

Joint distributions – Marginal and Conditional distributions – Functions of two dimensional random variables – Regression Curve – Correlation.

UNIT III ESTIMATION THEORY 9+6

Unbiased Estimators – Method of Moments – Maximum Likelihood Estimation - Curve fitting by Principle of least squares – Regression Lines.

UNIT IV TESTING OF HYPOTHESES 9+6

Sampling distributions - Type I and Type II errors - Tests based on Normal, t, Chi-Square and F distributions for testing of mean, variance and proportions – Tests for Independence of attributes and Goodness of fit.

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UNIT V **MULTIVARIATE ANALYSIS** **9+6**

Random Vectors and Matrices - Mean vectors and Covariance matrices - Multivariate Normal density and its properties - Principal components Population principal components – Principal components from standardized variables

TOTAL: L : 45 + T : 30 = 75

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version), 6th Edition	John Wiley & Sons, Inc.	2016
2.	Richard A. Johnson and Dean W. Wichern	Applied Multivariate Statistical Analysis, 6th Edition	Pearson Education, Asia	2015
3.	Gupta S.C. and Kapoor V.K	Fundamentals of Mathematical Statistics	Sultan Chand & Sons	2014
4.	HweiP.Hsu,	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Tata Mc Graw Hill Edition, New Delhi	2014
5.	Walpole, R.E., Myers, R.H., Myers, S.L. and Ye, K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

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PROFESSIONAL CORE (PC)

21CSB01	ADVANCED DATA STRUCTURES AND ALGORITHMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To review the basic data structures such as list, stack & queue and introduce concurrency on them.
2. To learn advanced search structures such as Splay tree, Red Black trees, Multi way search tree and Skip lists.
3. To study advanced heap structures such as Leftist Heaps, Binomial Heaps and Fibonacci Heaps.
4. To introduce various advanced concurrent structures.
5. To learn the various advanced algorithms.

COURSE OUTCOMES

21CSB01.CO1	Implement and apply concurrency in linked lists, stacks and queues.
21CSB01.CO2	Perform operations on advanced search trees.
21CSB01.CO3	Design and implement various types of advanced heaps structures.
21CSB01.CO4	Implement advanced concurrent structures such as hash table & priority queue.
21CSB01.CO5	Solve applications using advanced algorithm such as Randomized, Approximation and Parallel algorithms.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB01.CO1	x	x	x	-	-	-	-	-	-	-	-	-	x	x	-
21CSB01.CO2	x	x	x	-	-	-	-	-	-	-	-	-	x	x	-
21CSB01.CO3	-	x	x	-	x	-	-	-	-	-	-	-	x	x	-
21CSB01.CO4	-	x	x	-	x	-	-	-	-	-	-	x	-	x	-
21CSB01.CO5	-	-	x	x	x	-	-	-	-	-	-	-	x	x	-

UNIT I **DATA STRUCTURES AND CONCURRENCY** 9

Review of elementary data structures – data structures and concurrency – locking linked lists – coarse-grained synchronization – fine-grained synchronization – lazy synchronization – non-blocking synchronization – concurrent queues – bounded partial queues – unbounded lock-free queues – dual data structures – concurrent stacks – elimination back off stack.

UNIT II **ADVANCED SEARCH STRUCTURES** 9

Binary Search tree - Splay tree - Red Black trees – Interval tree - 2-D tree – Digital Search tree – Multi way Trie - Skip lists.

UNIT III **ADVANCED HEAP STRUCTURES** 9

Min heap - Min-Max heap - Double ended heap – Leftist Heaps - Binomial Heaps – Fibonacci Heaps – Skew Heaps - Interval Heap.

UNIT IV **ADVANCED CONCURRENT STRUCTURES** 9

Concurrent hashing – closed-address hash sets – lock-free hash sets – open-addressed hash sets – lock-based concurrent skip lists – lock-free concurrent skip lists – concurrent priority queues – bounded priority queue – unbounded priority queue – concurrent heap – skip list based unbounded priority queues.

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UNIT V **ADVANCED ALGORITHMS** 9

Introduction to Approximation algorithms: Vertex cover - Travelling Salesman Problem - knapsack problem. Introduction to Randomized algorithms – Randomized Searching and Sorting - Online hiring problem. Introduction to Parallel algorithms – parallel sorting algorithms - Odd-even transposition sort - Quick sort based parallel sort.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	S.K. Chang	Data Structures and Algorithms–Series of Software Engineering and Knowledge Engineering.	World Scientific Publishing	2003.
2.	M. Herlihy and N. Shavit, Morgan Kaufmann	The Art of Multiprocessor Programming	Pearson education	2012.
3.	E. Horowitz, S.Sahni and Dinesh Mehta	Fundamentals of Data structures in C++	Universities Press	2007.
4.	Thomas H Cormen, Charles E Leiserson, Ronald L Rivest and Clifford Stein	Introduction to Algorithms	Prentice Hall of India, New Delhi	2007
5.	Michael J. Quinn	Parallel Computing: Theory & Practice	Tata McGraw Hill Edition.	2003

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21CSB02 **ADVANCED DATASTRUCTURES AND ALGORITHMS LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

1. Understand the concept of linear and non linear data structures
2. Implement Various operations of tree concept
3. Design and analyze and Concepts of different types of heap
4. Analyze hashing , probing methods like linear probing and quadratic probing tree
5. Identify suitable data structure to solve various computing problems

COURSE OUTCOMES

21CSB02.CO1	Design and implement Stack operation and double ended Queue
21CSB02.CO2	Implement Tree operations in Binary search tree and red black tree
21CSB02.CO3	Perform the operations on Fibonacci tree and Binomial tree Operation
21CSB02.CO4	Apply hashing function to implement hash Data Structure and Implement Binary search tree
21CSB02.CO5	Analyze greedy algorithm and divide and conquer technique and implement quick sort and travelling sales man problem

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB02.CO1	x	x	x	-	-	-	-	-	-	-	-	-	x	x	-
21CSB02.CO2	x	x	x	-	-	-	-	-	-	-	-	-	x	x	-
21CSB02.CO3	-	x	x	-	x	-	-	-	-	-	-	-	x	x	-
21CSB02.CO4	x	-	x	-	x	-	-	-	-	-	-	-	x	x	-
21CSB02.CO5	-	-	x	x	x	-	-	-	-	-	-	-	x	x	-

Sl.No **List of Experiments**

1. Implement Stacks of size m" with all the basic operations such as Is Empty(i),Push(i), Pop(i), IsFull(i) where „i" denotes the element in a stack
2. Design and implement double ended Queue and its operations using Linked List
3. Beginning with an empty binary search tree, Construct binary search tree by inserting the values in the order given. After constructing a binary tree –
   i. Insert new node
   ii. Find number of nodes in longest path
   iii. Minimum data value found in the tree
   iv. Search a value
4. Implement a Red Black tree Operation
5. Implement Fibonacci tree Operation –
   i. Create Fibonacci tree
   ii. Insert new node in Fibonacci tree
   iii. Get Minimum value
6. Implement Binomial tree Operation –
   i. Create Binomial tree
   ii. Insert new node in Binomial tree
   iii. Get Minimum value

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7 Write a program to store k keys into an array of size n at the location computed using a hash function, loc =key % n, where k<=n and k takes values from [1 to m], m>n.

8 Beginning with an empty binary search tree, Construct min priority Queue by inserting the values in the order given. After constructing a priority tree –

i. Insert new node
ii. Delete a given node
iii. Find Min value node in a priority queue tree

9 Implement Program for Travelling Salesman Problem

10 Implement Quick Sort on 1D array of Student structure (contains student name, student_roll_no,total_marks), with key as student_roll_no

TOTAL : P : 30

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21CSB03	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

COURSE OUTCOMES

21CSB03.CO1 Identify the perspectives of machine learning
21CSB03.CO2 Apply decision tree and Artificial neural networks for real world problems
21CSB03.CO3 Design a Bayesian classifier for solving a problem
21CSB03.CO4 Illustrate the principles of instance based learning and genetic algorithm
21CSB03.CO5 Describe the algorithms for rule and reinforcement learning

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB03.CO1	x	x	x	x	-	x	-	-	x	x	-	x	x	-	x
21CSB03.CO2	x	x	x	x	-	-	x	-	-	-	x	x	-	x	-
21CSB03.CO3	x	x	x	-	-	x	-	-	-	-	x	-	x	-	x
21CSB03.CO4	x	x	x	-	x	-	-	-	x		-	x	-	x	-
21CSB03.CO5	x	x	x	-	-	c	-	x	-	x	x	-	x	-	x

UNIT I **INTRODUCTION** 9

Learning Problems - Designing a Learning System - Perspectives and Issues in Machine Learning – Concept Learning – task – search – finding maximally specific Hypotheses – version spaces and candidate elimination algorithm-inductive bias.

UNIT II **DECISION TREE LEARNING AND ARTIFICIAL NEURAL NETWORKS** 9

Decision Tree Representation – Problems – basic decision tree learning algorithms – hypotheses search – Issues – Artificial Neural Networks: Introduction – Representations – Problems – Perceptrons – Multilayer networks and Back Propagation Algorithm – example.

UNIT III **BAYESIAN LEARNING** 9

Bayes Theorem – Concept Learning – Maximum Likelihood and Least-Squared Error Hypothesis - Maximum Likelihood Hypotheses for Predicting Probabilities - Bayes Optimal Classifier - Gibbs Algorithm - Naïve Bayes Classifier – Example.

UNIT IV **INSTANCE BASED LEARNING AND GENETIC ALGORITHM** 9

Introduction – k-Nearest Neighbour Learning – Locally Weighted Regression - Radial Basis Functions - Case-Based Reasoning. Genetic Algorithm – Example – Hypothesis Space Search – Genetic Programming- Models of Evolution and Learning – Parallelizing Genetic Algorithms.

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UNIT V

LEARNING SETS OF RULES 9

Learning sets of rules: Introduction – sequential covering algorithms – First order rules – FOIL – Induction as Inverted deduction – inverting resolution – Reinforcement learning – Introduction – Learning task – Q learning

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Tom M. Mitchell	Machine Learning	Indian Edition, McGraw-Hill Education (India)	2013
2.	Simon Rogeres and Mark Girolami	A First Course in Machine Learning	CRC Press	2015
3.	Ethem Alpaydin	Introduction to Machine Learning	3rd Edition, Prentice Hall India	2015
4.	Christopher Bishop	Pattern Recognition and Machine Learning	Springer	2007

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21CSB04	MACHINE LEARNING TECHNIQUES LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To understand the concept of algorithms and illustrate the hypothesis using sets of trained data
2. To learn and understand the concept of building the decision tree and Artificial neural networks using sample data sets.
3. To evaluate and understand the concept of Bayesian classifier using sample trained data sets.
4. To understand the EM algorithm and k-mean algorithms using trained data set
5. To understand the concept of Regression algorithm and nearest neighbor algorithm

COURSE OUTCOMES

21CSB04.CO1 Identify the algorithms for trained data samples.
21CSB04.CO2 Understanding the concept of decision tree and Artificial neural networks
21CSB04.CO3 Develop the sample data sets by calculating the accuracy, precision and recall.
21CSB04.CO4 Compare the results of two different algorithms based on ML library classes and API
21CSB04.CO5 Implement the algorithm for data sets based on predictions using data graph in order to fit the data points.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB04.CO1	x	x	X	-	x	x	-	x	x	x	-	x	x	x	x
21CSB04.CO2	x	x	X	x	x	x	-	-	x	-	-	x	x	x	-
21CSB04.CO3	x	x	X	-	x	-	x	-	-	x	x	x	x	--	x
21CSB04.CO4	y	x	X	x	x	-	-	x	-	x	x	x	-	x	-
21CSB04.CO5	x	x	X	-x	x	-	x	-	x	-	x	x	-	x	x

Sl.No **List of Experiments**

1. Implement and demonstrate the FIND S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
2. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate
3. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
4. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets.
6. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.

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8	Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and commenton the quality of clustering. You can add Java/Python ML library classes/API in the program.
9	Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
10	Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.

TOTAL : P : 30

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21CSB05	CLOUD COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To learn how to apply trust-based security model to real-world security problems.
2. To study the concepts, processes and best practices needed to successfully secure information within Cloud infrastructures.
3. 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.

COURSE OUTCOMES

21CSB05.CO1 Identify security aspects of each cloud model.
21CSB05.CO2 Develop a risk-management strategy for moving to the cloud.
21CSB05.CO3 Implement a public cloud instance using a public cloud service provider.
21CSB05.CO4 Apply trust based security model to different layer.
21CSB05.CO5 Examine the concept of audit and compliance.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB05.CO1	X	X	X	X	-	-	-	-	-	-	-	-	X	-	-
21CSB05.CO2	X	X	X	-	X	-	-	-	-	-	X	-	-	X	-
21CSB05.CO3	X	X	X	-	-	-	-	-	-	-	X	-	X	-	-
21CSB05.CO4	X	X	X	-	X	X	-	-	-	-	-	X	-	X	-
21CSB05.CO5	X	-	-	-	X	-	-	-	-	-	X	X	X	-	-

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.

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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 : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John Rhoton	Cloud Computing Explained: Implementation Handbook for Enterprises	Amazon.com	2009
2.	Tim Mather	Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance (Theory in Practice)	O'Reilly Media	2009
3.	Rajkumar Buyya	Christian Vecchiola, and ThamaraiSelvi, "Mastering Cloud Computing"	Tata McGraw Hill Edition	2013
4.	Tom White	Hadoop: The Definitive Guide	Yahoo Press	2012

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21CSB06	CLOUD COMPUTING LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To learn how to apply trust-based security model to real-world security problems.
2. To study the concepts, processes and best practices needed to successfully secure information within Cloud infrastructures.
3. 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.

COURSE OUTCOMES

21CSB06.CO1 Identify security aspects of each cloud model.
21CSB06.CO2 Develop a risk-management strategy for moving to the cloud.
21CSB06.CO3 Implement a public cloud instance using a public cloud service provider.
21CSB06.CO4 Apply trust based security model to different layer.
21CSB06.CO5 Examine the concept of audit and compliance.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB06.CO1	X	X	X		-	X	-	-	-	-	-	-	X	-	-
21CSB06.CO2	X	X	X	-	X	-	-	-	-	-	X	-	-	X	-
21CSB06.CO3	X	X	X	-	-	-	-	-	X	-	X	-	X	-	-
21CSB06.CO4	X	X	-	X	-	X	-	-	-	-	-	X	-	X	-
21CSB06.CO5	X	-	-	-	X	-	-	X	-	-	X	X	X	-	-

Sl.No	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 : P : 30

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21CSB07 ADVANCED OPERATING SYSTEMS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To learn the fundamentals of Operating Systems
2. To gain knowledge on Distributed operating system concepts that includes architecture, Mutual exclusion algorithms, Deadlock detection algorithms and agreement protocols
3. To gain insight on to the distributed resource management components
4. To know the components of Real time, Mobile operating systems.
5. To learn the management aspects of Mobile operating systems

COURSE OUTCOMES

21CSB07.CO1	Discuss the various synchronization, scheduling and memory management issues.
21CSB07.CO2	Demonstrate the Mutual exclusion, Deadlock detection and agreement protocols of Distributed Operating system.
21CSB07.CO3	Discuss the various resource management techniques for distributed systems.
21CSB07.CO4	Identify the different features of real time and mobile operating systems.
21CSB07.CO5	Ability To Learn the management aspects of Mobile operating systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB07.CO1	x	x	x	-	-	-	-	-	x	x	-	x	-	x	-
21CSB07.CO2	x	x	x	-	x	-	-	-	x	-	x	-	x	-	x
21CSB07.CO3	x	x	x	-	-	-	-	-	x	x	-	-	x	x	-
21CSB07.CO4	x	x	x	-	-	-	-	-	-	-	x	x	-	x	x
21CSB07.CO5	x	x	x	-	x	-	-	-	x	x	x	-	x	x	x

UNIT I FUNDAMENTALS OF OPERATING SYSTEMS 9

Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques.

UNIT II DISTRIBUTED OPERATING SYSTEMS 9

Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport's Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols.

UNIT III DISTRIBUTED RESOURCE MANAGEMENT 9

Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Non blocking Commit Protocol – Security and Protection.

UNIT IV REAL TIME AND MOBILE 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 –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system.

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UNIT V **CASE STUDIES** 9

Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System – Inter process Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Mukesh Singhal and Niranjan G. Shivaratri	Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems	Tata McGraw-Hill	2001
2.	Abraham Silberschatz; Peter Baer Galvin; Greg Gagne	Operating System Concepts	John Wiley & Sons	2004
3.	Daniel P Bovet and Marco Cesati	Understanding the Linux Kernel	O'Reilly	2005
4.	Singhal	Advanced concepts in operating systems	TataMcGraw-Hill Education	2001
5.	Dang Van Duc	Operating System	Institute of Information Technology	2012

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21CSB08	IMAGE PROCESSING AND ANALYSIS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Learn digital image fundamentals.
2. Be familiar with image enhancement techniques in spatial and frequency domain
3. Be familiar with image compression and segmentation techniques and morphological image processing
4. Understand the concept of image representation and description
5. Learn to recognition image in form of features

COURSE OUTCOMES

21CSB08.CO1 Explain the fundamentals of Digital image and its Processing
21CSB08.CO2 Perform Image Enhancement Techniques in spatial and frequency domain
21CSB08.CO3 Apply the concept of image segmentation and Morphological Image processing
21CSB08.CO4 Use various image Representation and Description techniques
21CSB08.CO5 Describe Object detection and Recognition Techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB08.CO1	X	-	-	-	X	-	-	-	-	-	X	X	-	X	-
21CSB08.CO2	X	X	X	-	X	-	-	-	-	-	X	X	-	X	-
21CSB08.CO3	X	X	X	-	X	-	-	-	-	-	X	X	-	X	-
21CSB08.CO4	X	X	X	-	X	-	-	-	-	-	X	X	-	X	-
21CSB08.CO5	X	X	X	X	X	-	-	-	-	-	X	X	-	X	-

UNIT I INTRODUCTION TO IMAGE PROCESSING AND COMPUTER 9

Introduction, Digital Image Fundamentals, image acquisition and display using digital devices - Human visual perception, properties–Image Formation-Image sampling and quantization- Basic relationship between pixels.

UNIT II IMAGEENHANCEMENT 9

Image enhancement in the spatial domain : basic grey level transformation, Histogram Processing - Enhancement using arithmetic/Logic operations – Spatial filtering: smoothing and sharpening.

Image enhancement in the frequency domain: Introduction to two - dimensional transforms- Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform – smoothing frequency domain filtering - sharpening frequency domain filtering.

UNIT III RPHOLOGICALIMAGEPROCESSINGANDIMAGESEGMENTATION 9

Morphological Image Processing: Dilation and Erosion –Opening and Closing – Hit or Miss Transformation – Basic morphological algorithm

Image Segmentation: Detection of discontinuities- Object Detection Methods, Edge Liking andBoundary Detection, Thresholding Methods, Region Oriented Methods.

UNIT IV REPRESENTATION AND DESCRIPTION 9

Chain codes, Polygonal approximation, Signature Boundary Segments, Skeletons, Boundary Descriptors, Regional Descriptors, Some Simple Descriptors Topological Descriptors Texture Moment Invariants Use of Principal Components for Description Relational Descriptors.

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UNIT V **OBJECT RECOGNITION** 9

Patterns and Pattern Classes Recognition Based on Decision-Theoretic Methods Optimum Statistical Classifiers Neural Networks Matching Biological Neural Network, McCulloch Pitts Neuron, Thresholding Logic, Perceptron, Perceptron Learning Matching Shape Numbers String Matching Algorithm Feed forward Neural Network, Back propagation Neural Network

TOTAL : L : 45

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	1. Rafael C. Gonzalez , Richard E . Woods	Digital Image Processing	Pearson Education, Third Edition	2013
2.	A.K. Jain	Fundamentals of Digital Image Processing.	Prentice Hall India	1988

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	David A .Forsyth , JeanPonce	Computer Vision : A ModernApprach	Prentice Hall ; Second edition	2011
2.	Scott E Umbaugh	Digital Image Processing andAnalysis: Human and ComputerVision Application with CVIPtools	Second Edition , CRC Press	2011

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		L	T	P	C
21CSB09	IMAGE PROCESSING AND ANALYSIS LABORATORY	0	0	2	1

COURSE OBJECTIVES

1. Be exposed to simple image processing techniques.
2. Be familiar with image enhancement and segmentation techniques.
3. Be familiar with morphological and image transform.

COURSE OUTCOMES

21CSB09.CO1 Perform the image enhancement and edge detection
21CSB09.CO2 Implement Morphological operation
21CSB09.CO3 Demonstrate image transform and Color image processing

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB09.CO1	X	-	-	-	X	-	-	-	-	-	X	X	-	X	-
21CSB09.CO2	X	X	X	-	X	-	-	-	-	-	X	X	-	X	-
21CSB09.CO3	X	X	X	-	X	-	-	-	-	-	X	X	-	X	-

Sl.No **List of Experiments**

1. Program to enhance image using image arithmetic and logical operations.
2. Program for image enhancement using histogram equalization.
3. Program for image enhancement using Image Negative and Gray level slicin
4. Program to filter an image using averaging low pass filter in spatial domain and median filter.
5. Program for smooth an image using low pass filter in frequency domain.(Butterworth lpf)
6. Program for smooth an image using high pass filter in frequency domain.(Butterworth hpf)
7. Program for morphological image operations-erosion, dilation, opening &closing.
8. Program for edge detection algorithm.
9. To fill the region of interest for the image.
10. Program of sharpen image using gradient mask.

Total : P : 30

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21CSB10	SOFT COMPUTING	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Classify the various soft computing frame works
2. Be familiar with the design of neural networks, fuzzy logic and fuzzy systems
3. Learn mathematical background for optimized genetic programming
4. Be exposed to neuro-fuzzy hybrid systems and its applications

COURSE OUTCOMES

21CSB10.CO1 Apply various soft computing concepts for practical applications

21CSB10.CO2 Choose and design suitable neural network for real time problems

21CSB10.CO3 Use fuzzy rules and reasoning to develop decision making and expert system

21CSB10.CO4 Explain the importance of optimization techniques and genetic programming

21CSB10.CO5 Review the various hybrid soft computing techniques and apply in real time problems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB10.CO1	x	-	x	-	-	-	-	-	-	-	-	x	x	-	-
21CSB10.CO2	x	x	-	-	-	-	-	x	-	-	-	x	x	x	-
21CSB10.CO3	x	x	-	x		-	-	-	-	-	-	x	-	x	x
21CSB10.CO4	x	x	x	x	x	-	-	-	x	x	x	-	-	-	x
21CSB10.CO5	x	x	x	x	x	-	-	-	-	-	x	x	-	-	x

UNIT I **INTRODUCTION TO SOFT COMPUTING** 9

Soft Computing Constituents-From Conventional AI to Computational Intelligence- Artificial neural network: Introduction, characteristics- learning methods – taxonomy – Evolution of neural networks - basic models - important technologies - applications. Fuzzy logic: Introduction - crisp sets- fuzzy sets - crisp relations and fuzzy relations: cartesian product of relation - classical relation, fuzzy relations, tolerance and equivalence relations, non-iterative fuzzy sets. Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts.

UNIT II **NEURAL NETWORKS** 9

McCulloch-Pitts neuron - linear separability - hebb network - supervised learning network: perceptron networks - adaptive linear neuron, multiple adaptive linear neuron, BPN, RBF, TDNN- associative memory network: auto-associative memory network, hetero-associative memory network, BAM, hopfield networks, iterative auto associative memory network & iterative associative memory network –unsupervised learning networks: Kohonen self-organizing feature maps, LVQ – CP networks, ART network.

UNIT III **FUZZY LOGIC** 9

Membership functions: features, fuzzification, methods of membership value assignments-Defuzzification: lambda cuts - methods - fuzzy arithmetic and fuzzy measures: fuzzy arithmetic - extension principle - fuzzy measures - measures of fuzziness -fuzzy integrals - fuzzy rule base and approximate reasoning : truth values and tables, fuzzy propositions, formation of rules-decomposition of rules, aggregation of fuzzy rules, fuzzy

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reasoning-fuzzy inference systems-overview of fuzzy expert system-fuzzy decision making.

UNIT IV **GENETIC ALGORITHM** 9

Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation – crossover - mutation - genetic programming – multilevel optimization – real life problem- advances in GA .

UNIT V **HYBRID SOFT COMPUTING TECHNIQUES & APPLICATIONS** 9

Neuro-fuzzy hybrid systems - genetic neuro hybrid systems - genetic fuzzy hybrid and fuzzy genetic hybrid systems - simplified fuzzy ARTMAP - Applications: A fusion approach of multispectral images with SAR, optimization of traveling salesman problem using genetic algorithm approach, soft computing based hybrid fuzzy controllers.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	J.S.R.Jang, C.T. Sun and E.Mizutani	Neuro-Fuzzy and Soft Computing	PHI / Pearson Education	2004
2.	S.N.Sivanandam and S.N.Deepa	Principles of Soft Computing	Wiley India Pvt Ltd	2011
3.	S.Rajasekaran and G.A.Vijayalakshmi Pai	Neural Networks, Fuzzy Logic and Genetic Algorithm Synthesis and Applications	Prentice-Hall of India Pvt. Ltd.,	2006
4.	George J. Klir, Ute St. Clair, Bo Yuan,	Fuzzy Set Theory	Foundations and Applications Prentice Hall,	1997
5.	David E. Goldberg	Algorithm in Search Optimization and Machine Learning	Genetic Pearson Education India	2013
6	James A. Freeman, David M. Skapura	Neural Networks Algorithms, Applications, and Programming Techniques	Pearson Education India	1991
7	Simon Haykin	Neural Networks	Comprehensive Foundation Second Edition Pearson Education	2005

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21CSB11	RESEARCH METHODOLOGY AND IPR	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

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

COURSE OUTCOMES

21CSB11.CO1	Understand research problem formulation.
21CSB11.CO2	Analyze research related information
21CSB11.CO3	Follow research ethics
21CSB11.CO4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity
21CSB11.CO5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB11.CO1	X	-	-	X	-	-	X	-	X	-	X	-	-	X	-
21CSB11.CO2	-	X	-	-	X	-	-	X	-	-	X	-	X	-	-
21CSB11.CO3	-	X	-	X	-	X	X	-	-	-	X	-	-	-	-
21CSB11.CO4	-	X	X	-	X	-	-	-	X	-	-	X	-	-	-
21CSB11.CO5	-	-	X	-	X	-	-	-	X	-	X	-	-	X	-

UNIT I **BASICS OF RESEARCH PROBLEM** 9

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** 9

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** 9

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** 9

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

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UNIT V DEVELOPMENTS IN IPR 9

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 : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Wayne Goddard and Stuart Melville	Research methodology: an introduction for science & engineering students	Juta and Company Ltd, 2nd Edition	2004
2.	Ranjit Kumar	Research Methodology: A Step by Step Guide for beginners	2nd Edition	2004
3.	Halbert	Resisting Intellectual Property	Taylor & Francis Ltd	2007
4.	Mayal	Industrial Design	McGraw Hill	1992
5.	Niebel	Product Design	McGraw Hill	1974
6.	Asimov	Introduction to Design	Prentice Hall	1952
7.	Robert P. Merges, Peter S. Menell, Mark A. Lemley,	Intellectual Property in New Technological Age	McGraw Hill	2016

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21CSB12 DATA MINING TECHNIQUES

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3	0	0	3

COURSE OBJECTIVES

1. To learn the fundamentals of Data mining
2. To gain knowledge on association rule concepts in real time systems
3. To gain insight on various classification
4. To gain insight on different clustering methods
5. To study the different types of tools for complex mining techniques

COURSE OUTCOMES

21CSB12.CO1 Apply the functionalities of data mining in real time applications.
21CSB12.CO2 Do the preprocessing and apply association rule concepts in real time systems
21CSB12.CO3 Implement the various classification
21CSB12.CO4 Implement the different clustering methods
21CSB12.CO5 Study the different tools for complex mining techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB12.CO1	x	x	x	-	-	-	-	-	x	x	x	x	x	-	x
21CSB12.CO2	x	x	x	-	-	x	-	-	x	x	x	x	-	-	-
21CSB12.CO3	x	x	x	-	x	-	-	-	x	-	x	x	x	x	-
21CSB12.CO4	x	x	x	-	x	-	-	-	x	-	x	x	x	x	-
21CSB12.CO5	x	x-	x	-	x	-	-	-	x	x	x	-	x	-	x

UNIT I INTRODUCTION 9

Data Mining-Steps in Knowledge Discovery Process- Kinds of Data and Patterns – Technologies used-Targeted applications - Major issues in Data Mining - Data objects and attribute types - Statistical descriptions of data - Data Visualization- Measuring data similarity and dissimilarity.

UNIT II DATA PREPROCESSING 9

Data Cleaning, Integration, Reduction, Transformation and Discretization, Mining Frequent Patterns – Frequent Item set Mining Methods.

UNIT III CLASSIFICATION 9

Decision Tree Induction-Bayesian Classification - Rule based Classification - classification by Back Propagation – Support Vector Machines – Lazy Learners – Model Evaluation and Selection – Techniques to improve Classification Accuracy - k-Nearest Neighbor Classifier.

UNIT IV CLUSTER ANALYSIS 9

Clusters Analysis: Partitioning Methods – Hierarchical Methods – Density based Methods – Grid based Methods - Evaluation of Clustering – Outliers and Outlier analysis – Outlier detection Methods - Statistical Approaches.

UNIT V APPLICATIONS 9

Rules - Knowledge Bases - Active And Deductive Databases - Parallel Databases - Multimedia Databases - Image Databases - Text Database Mining Complex data types - Statistical Data Mining - Data Mining Foundations –

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Visual and Audio Data Mining – Applications - Ubiquitous and invisible Data Mining - Social impacts of Data Mining .

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Jiawei Han Micheline Kamber	Data Mining Concepts and Techniques	3rd Edition, Elsevier	2011.
2.	Alex Berson, Stephen J. Smith	Data Warehousing, Data Mining & OLAP	Tata McGraw Hill	2007.
3.	K.P. Soman, Shyam Diwakar and V. Ajay	Insight into Data mining Theory and Practice	2nd Edition, Prentice Hall of India	2006.
4.	G. K. Gupta	Introduction to Data Mining with Case Study	Prentice Hall of India	2011
5.	Pang-Ning Tan, Michael Steinbach Vipin Kumar	Introduction to Data Mining	2ndEdition,Pearson Education	2007

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21CSB13 NETWORK DESIGN AND TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the fundamental concepts of computer networks.
2. To understand the design of Network architectures.
3. To understand the working principles of different protocols in various layers.
4. To study the implementation concepts in congestion control
5. To study the implementation concepts in error detections

COURSE OUTCOMES

21CSB13.CO1 Familiar with the basics of Computer Networks.
21CSB13.CO2 Understand Network architectures.
21CSB13.CO3 Understand Concepts of fundamental protocols.
21CSB13.CO4 Understand the knowledge of internetworking concepts in various applications.
21CSB13.CO5 Ability to study the implementation concepts in error detections

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB13.CO1	x	x	-	-	x	-	x	-	-	-	-	x	x	-	x
21CSB13.CO2	-	-	x	x	-	x	-	-	x	-	-	-	-	-	x
21CSB13.CO3	x	-	x	-	x	-	-	-	-	x	-	-	x	-	-
21CSB13.CO4	-	x	-	x	x	-	-	x	-	-	-	x	-	x	-
21CSB13.CO5	-	-	x	x	x	-	-	-	x	-	-	-	-	-	x

UNIT I NETWORK DESIGN FUNDAMENTALS 9

Introduction -Cooperative communications -The OSI model -The TCP/IP model -The Internet protocols-Networking hardware-Physical connectivity-Virtual connectivity.

UNIT II NETWORK MONITORING AND ANALYSIS 9

Network monitoring and Analysis: An effective network monitoring LAN and WAN - Monitoring yournetwork -The dedicated monitoring server – monitoring various network parameters - characteristics of monitoring tools - Types of monitoring tools-Spot check tools-Log analyzers-Trending tools-Real time tools-Benchmarking-Interpret the traffic graph - Monitoring RAM and CPU usage.

UNIT III WIRELESS NETWORKS 9

IEEE802.16 and WiMAX – Security – Advanced 802.16 Functionalities – Mobile WiMAX - 802.16e – Network Infrastructure – WLAN – Configuration – Management Operation – Security – IEEE 802.11e and WMM – QoS – Comparison of WLAN and UMTS.

UNIT IV 4G AND 5G NETWORKS 9

4G and 5G Networks : LTE – Network Architecture and Interfaces – FDD Air Interface and Radio Networks – Scheduling – Mobility Management and Power Optimization – LTE Security Architecture – Interconnection with UMTS and GSM – LTE Advanced (3GPPP Release 10)- 4G Networks and Composite Radio Environment – Protocol Boosters – Hybrid 4G Wireless Networks Protocols – Green Wireless Networks – Physical Layer and Multiple Access – Introduction to 5G.

UNIT V SOFTWARE DEFINED NETWORKS 9

Software Defined Networks: Introduction – Centralized and Distributed Control and Data Planes – Open Flow – SDN Controllers .

TOTAL: 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Martin Sauter	From GSM to LTE, An Introduciton to Mobile Networks and Mobile Broadband	1st Edition Wiley	2014
2.	Thoman D. Nadeau, and Ken Gray	SDN - Software Defined Networks	1st Edition, O"Reilly Publishers	2013
3.	-	Packet Analyzer and Network Management Tools	-	-

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21CSB14 **ADVANCED SOFTWARE ENGINEERING**

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3	0	0	3

COURSE OBJECTIVES

1. To realize the relationship between UML diagrams
2. To design and test software project
3. To understand the concept of system design
4. To understand the concept of object design.
5. To understand the concepts of testing

COURSE OUTCOMES

21CSB14.CO1 Execute the software project using software engineering methodologies
21CSB14.CO2 Design various UML diagrams and inter relate them
21CSB14.CO3 Design, test and manage the software project using various tools
21CSB14.CO4 Analyze the concept of system design
21CSB14.CO5 Analyze the concept of object design

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB14.CO1	X	X	-	-	-	-	-	-	-	-	-	-	X	X	-
21CSB14.CO2	X	-	X	-	-	-	-	-	-	-	-	X	-	-	-
21CSB14.CO3	X	-	-	X	X	-	-	-	-	-	-	-	-	X	-
21CSB14.CO4	X	-	X	X	-	-	-	-	X	-	-	X	-	X	X
21CSB14.CO5	-	-	X	X	X	-	-	-	X	-	-	X	X	-	X

UNIT I **INTRODUCTION SOFTWARE ENGINEERING** 9

Software engineering concepts -Software engineering development activities - Managing software development -Introduction to UML- Modeling concepts – UML diagrams - Project organizations - Project communication concepts- Organizational activities

UNIT II **REQUIREMENTS ELICITATION AND ANALYSIS** 9

An overview of requirements elicitation – Requirements elicitation concepts - Requirements elicitation activities -Managing requirements elicitation - Analysis overview – Concepts of analysis - Activities: from use cases to objects- Managing analysis

UNIT III **SYSTEM DESIGN AND OBJECT DESIGN** 9

Decomposing the system- An overview of system design - System design concepts - System design activities – From objects to subsystems - Addressing design goals - Managing system design - Object design - Reusing pattern solutions - Reuse concepts - Solution objects – Inheritance - Design patterns - Reuse activities - Managing reuse.

UNIT IV **TESTING AND MANAGING CHANGES** 9

Testing concepts - Testing activities - Component inspection- Managing testing - Rationale management – Rationale concepts - Rationale activities - From issues to decisions - Managing rationale heuristics for communicating about rationale - Issue modeling and negotiation - Conflict resolution strategies.

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UNIT V **CONFIGURATION MANAGEMENT AND PROJECT MANAGEMENT** 9

Configuration management concepts - Configuration management activities - Managing configuration management- Project management - Project management concepts - Classical project management activities - Agile project management activities.

TOTAL : L : 45

Reference Books:

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Sommer ville	Software Engineering	Pearson Education	2009
2.	Roger S. Pressman	Software Engineering - A Practitionar's Approach	McGraw-Hill International Edition,	2012
3.	Robert N. Britcher	The Limits of Software: People, Projects, and Perspectives	Addison-Wesley Pub Co; 1st edition	2007
4.	Frederick P. Brooks	Essays on Software Engineering,	Addison-Wesley Pub Co; 1st edition	2005
5.	Richard H. Thayer	Requirements Engineering: A Good Practice Guide	Software Requirements Engineering.	2007

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21CSB15	ADVANCED DATABASE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand database systems, data models, database languages.
2. To be able to design a database system by understanding the concepts of functional dependencies and normalization.
3. To acquire the knowledge on its query processing.
4. To understand the principles of object oriented databases.
5. To gain knowledge about the emerging database technologies

COURSE OUTCOMES

21CSB15.CO1 Study the database systems, data models, database languages.
21CSB15.CO2 Able to design a database system by understanding the concepts of functional dependencies and normalization.
21CSB15.CO3 Apply the knowledge on its query processing.
21CSB15.CO4 Analyze the principles of object oriented databases.
21CSB15.CO5 Study about the different emerging database technologies.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB15.CO1	x	-	x	x	x	-	-	-	-	-	-	-	x	x	-
21CSB15.CO2	x	x	-	x	x	-	-	-	-	-	-	-	-	x	-
21CSB15.CO3	-	x	x	x	x	-	-	-	-	-	x	-	x	-	-
21CSB15.CO4	-	x	x	-	x	-	-	-	-	-	x	x	-	x	-
21CSB15.CO5	-	x	x	x	x	-	-	-	-	-	-	-	x	-	-

UNIT I DISTRIBUTED DATABASES 9

Distributed Databases Vs Conventional Databases - Architecture - Fragmentation - Query Processing - Transaction Processing - Concurrency Control - Recovery.

UNIT II OBJECT ORIENTED DATABASES 9

Introduction to Object Oriented Data Bases - Approaches - Modeling and Design - Persistence - Query Languages - Transaction - Concurrency - Multi Version Locks – Recovery

UNIT III EMERGING SYSTEMS 9

Enhanced Data Models - Client/Server Model - Data Warehousing and Data Mining - Web Databases - Mobile Databases.

UNIT IV DESIGN DATABASE ISSUES 9

ER Model - Normalization - Security - Integrity - Consistency - Database Tuning - Optimization and Research Issues - Design of Temporal Databases - Spatial Databases.

UNIT V CURRENT ISSUES 9

Rules - Knowledge Bases - Active And Deductive Databases - Parallel Databases - Multimedia Databases - Image Databases - Text Database

TOTAL : L : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Elisa Bertino, Barbara Catania, Gian Piero Zarri	Intelligent Database Systems	Addison-Wesley	2001
2.	Carlo Zaniolo, Stefano Ceri, Christos Faloustsos,R.T.Snodgrass, V.S.Subrahmanian,	Advanced Database Systems	Pearson Publication	1997
3.	Morgan KaufmanN.Tame Ozsu, Patrick Valduriez	Principles Of Distributed Database Systems	Prentice Hall International Inc	1999
4.	Abdullah Uz Tansel Et Al	Temporal Databases: Theory, Design and Principles	Benjamin Cummings Publishers	1993
5.	Raghu Ramakrishnan, Johannes Gehrke	Database Management Systems	McGraw Hill, Third Edition	2004

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21CSB16	ADVANCED DATABASE TECHNOLOGY LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To understand database systems, data models, database languages.
2. To be able to design a database system by understanding the concepts of functional dependencies and normalization.
3. To acquire the knowledge on its query processing.
4. To understand the principles of object oriented databases.
5. To gain knowledge about the emerging database technologies

COURSE OUTCOMES

21CSB16.CO1 Study the database systems, data models, database languages.
21CSB16.CO2 Able to design a database system by understanding the concepts of functional dependencies and normalization.
21CSB16.CO3 Apply the knowledge on its query processing.
21CSB16.CO4 Analyze the principles of object oriented databases.
21CSB16.CO5 Study about the different emerging database technologies.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB16.CO1	-	X	X	X	X	-	-	-	X	-	X	-	-	-	X
21CSB16.CO2	-	-	X	X	X	-	-	-	X	-	X	-	-	-	X
21CSB16.CO3	-	-	X	X	X	-	-	-	X	-	X	-	-	-	X
21CSB16.CO4	-	-	X	X	X	-	-	-	X	-	X	-	-	-	X
21CSB16.CO5	-	-	X	X	X	-	-	-	X	-	X	-	-	-	X

Sl.No	List of Experiments
1.	Implement parallel sorting and aggregates
2.	Implement parallel joins and Hash joins
3.	Implement semi join and bloom join in distributed DBMS
4.	Implement two phase commit in distributed DBMS
5.	Implementation of cube operator in OLAP queries in data warehousing and decision support system
6	Implement decision tree of data mining problem
7	Implement a priori algorithm in data mining
8	Simulation of a search engine
9	Implement view modification and materialization in data warehousing and decision support systems
10	Implementation of data log queries for deductive databases (Negation, Aggregate, Recursive etc.)

Minimum 8 to 10 experiments based on the syllabus and above experiment list should be implemented using ORACLE /MSSQL SERVER / JAVA.

TOTAL : P : 30

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21CSB17 **BIG DATA ANALYTICS** L T P C
3 0 0 3

COURSE OBJECTIVES

1. To understand the various algorithms for handling big data
2. To understand the techniques for handling big data
3. To learn No SQL database system
4. To learn concepts for Data stream mining
5. To analyse the stream computing

COURSE OUTCOMES

21CSB17.CO1 Understand how to leverage the insights from big data analytics through various algorithms
21CSB17.CO2 Analyze data by utilizing various statistical and data mining approaches
21CSB17.CO3 Perform analytics on real time data using Hadoop related tools
21CSB17CO4 Comprehend the various methods for mining the data
21CSB17.CO5 Analyze the concepts of real time data streaming

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSB17.CO1	X	X	X	X	-	-	-	X	-	X	-	X	X	-	-
21CSB17.CO2	-	-	X	X	X	-	X	-	X	-	X	-	-	X	X
21CSB17.CO3	X	X		-	-	-	X	-		X			-	X	-
21CSB17CO4	X	-	X	-	-	X		X		-	-	X	X	X	-
21CSB17.CO5	X	X	-	X	-	X	X	-	X	-	X	-	-	-	X

UNIT I **BIG DATA** 9

Big Data: Definition – Wholeness of big data: Understanding – Capturing –Benefits and management – Organizing and analyzing – Challenges – Big data architecture – Big data sources and applications: Big data sources – Machine to machine Communications- Big data Applications.

UNIT II **MAPREDUCE FRAMEWORK** 9

Introducing Hadoop – Starting Hadoop – Components of Hadoop: Working with files in HDFS - Anatomy of a MapReduce program – Reading and writing - Writing basic MapReduce programs: Getting the patent data set-Constructing the basic template of a MapReduce program-Counting things-Adapting for Hadoop"sAPI changes-Streaming in Hadoop- Improving performance with combiners – Hadoop Ecosystem

UNIT III **NOSQL DATABASE SYSTEMS** 9

Introduction to NoSQL – CAP theorem - MongoDB : Data types – MongoDB Query Language – Cassandra: Features of Cassandra- Data types – CRUD- Collections Alter Commands – Import and Export- Querying system tables.

UNIT IV **MINING DATA STREAMS** 9

Stream Data Model - Sampling Data in a Stream–Filtering Streams–Counting Distinct Elements in a Stream–Estimating Moments–Counting Ones in a Window–Decaying Window - Stream processing with SPARK and Kafka.

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UNIT V **CASE STUDIES** **9**

Implement using open source frameworks/tools : Time Series Analysis - Text analysis – Social Network Analysis - Data streams.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Anil Maheshwari	Big Data	1 st Edition, McGraw Hill Education	2017
2.	Chuck Lam	Hadoop in Action	2 nd Edition, Manning Publications	2011
3.	Seema Acharya and Subhashini Chellappan	Big Data and Analytics	1st Edition, Wiley	2015
4.	Pfleeger & Pfleeger	Security in Computing	Pearson Education, 3rd Edition	2003
5.	Carmit Hazay, Yehuda Lindell	Efficient Secure Two Party Protocols: Techniques and Constructions	Springer-Verlag	2010

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PROFESSIONAL ELECTIVE (PE)

21CSC01 **ADVANCED ALGORITHMS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

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

COURSE OUTCOMES

21CSC01.CO1 Analyze the complexity/performance of different algorithms.
21CSC01.CO2 Determine the appropriate data structure for solving a particular set of problems.
21CSC01.CO3 Categorize the different problems in various classes according to their complexity.
21CSC01.CO4 Students should have an insight of recent activities in the field of the advanced data structure.
21CSC01.CO5 Evaluate the linear programming of different algorithms

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC01.CO1	x	x	-	-	x	-	-	-	x	-	x	x	x	-	-
21CSC01.CO2	x	x	-	-	-	-	-	-	x	-	x	-	x	-	-
21CSC01.CO3	-	x	-	x	-	-	-	-	x	-	x	-	x	-	-
21CSC01.CO4	-	x	x	-	-	-	-	-	x	-	x	-	x	-	-
21CSC01.CO5	-	x	-	x	-	-	-	-	x	-	x	-	x	-	-

UNIT I **SORTING AND GRAPHING** 9

Sorting: Review of various sorting algorithms, topological sorting Graph: Definitions and Elementary Algorithms: Shortest path by BFS, shortest path in edge-weighted case (Dijkastra's), depth-first search and computation of strongly connected components, Emphasis on correctness proof of the algorithm and time/space analysis, example of amortized analysis.

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 introduction to 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.

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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 : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Cormen, Leiserson, Rivest, Stein	Introduction to Algorithms	MIT Press, 3rd Edition,	2009
2.	Aho, Hopcroft, Ullman	The Design and Analysis of Computer Algorithms	Addison-Wesley Longman	1985
3.	EthemAlpaydin	Introduction to Machine Learning	Data *Kleinberg*, Jon	2005
4.	Hari Mohan Pandy	Design analysis and Algorithms	University Science Press	2009
5.	Kleinberg and Tardos	Algorithm Design	Pearson	2006

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21CSC02 **ADVANCED ALGORITHMS LABORATORY**

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

1. To understand the concept of sorting and searching algorithms.
2. Analyze various algorithm to find minimum spanning tree.
3. To Study the Euclidean algorithm
4. To implement modular exponentiation techniques.
5. To apply matrix for various algorithms.

COURSE OUTCOMES

21CSC02.CO1 Understand the concept of sorting and searching algorithms
21CSC02.CO2 Implement Prim's algorithm to find minimum spanning tree.
21CSC02.CO3 Apply Dijkstra's algorithm to find shortest path.
21CSC02.CO4 Implement warshall's algorithm to find all pair shortest path.
21CSC02.CO5 Perform matrix calculation for various applications.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC02.CO1	x	x	x	-	x	-	-	-	-	-	x	-	x	-	-
21CSC02.CO2	-	x	x	-	x	-	-	-	-	-	x	-	x	-	-
21CSC02.CO3	-	x	x	-	x	-	-	-	-	-	x	-	-	x	-
21CSC02.CO4	-	x	x	-	x	-	-	-	-	-	x	-	-	x	-
21CSC02.CO5	-	x	x	-	x	-	-	-	-	-	x	-	x	-	-

Sl.No **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 and BFS.
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 : P : 30

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21CSC03 **WEB DATA MINING** L T P C
3 0 0 3

COURSE OBJECTIVES

1. Introduces basic concepts, tasks, methods, and techniques in web mining
2. Develop an understanding of the web mining process and issues, learn various techniques for data mining
3. Learn the techniques in solving data mining problems using tools
4. Understand classification and prediction algorithms for web data mining
5. Apply the techniques in solving data mining problems using data mining tools and systems

COURSE OUTCOMES

21CSC03.CO1 Gain the knowledge of basic concepts data mining and its functionalities.
21CSC03.CO2 Familiar with data mining and knowledge discovery process
21CSC03.CO3 Learn various techniques for web usage mining process and techniques
21CSC03.CO4 Learn classification and prediction algorithms for web data mining
21CSC03.CO5 Apply the techniques in solving data mining problems using data mining tools and systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC03.CO1	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-
21CSC03.CO2	x	x	x	-	x	-	-	-	-	-	x	-	-	x	-
21CSC03.CO3	x	x	-	-	-	-	-	-	x	-	x	-	x	-	-
21CSC03.CO4	x	x	-	-	x	-	-	-	-	x	-	x	-	x	-
21CSC03.CO5	x	x	-	-	x	-	-	-	x	-	-	-	-	-	x

UNIT I **INTRODUCTION** 9

What is Data Mining - Relational Databases - Data Warehouses - Transactional Databases - Advanced Database Systems - Data Mining Functionalities - Interestingness of a pattern Classification of Data Mining Systems - Major issues in Data Mining .

UNIT II **DATA MINING AND KNOWLEDGE DISCOVERY** 9

The KDD process and methodology - Data preparation for knowledge discovery - Overview of data mining techniques - Market basket analysis - Classification and prediction – Clustering - Memory-based reasoning - Evaluation and Interpretation.

UNIT III **WEB USAGE MINING PROCESS AND TECHNIQUES** 9

Data collection and sources of data- Data preparation for usage mining - Mining navigational patterns - Integrating e-commerce data - Leveraging site content and structure - User tracking and profiling - E- Metrics: measuring success in e-commerce Privacy issues.

UNIT IV **CLASSIFICATION AND PREDICTION** 9

Concepts and Issues regarding Classification and Prediction – Classification by Decision Tree Induction – Bayesian Classification - Classification by Back-propagation - Classification Based on Concepts from Association Rule Mining.

UNIT V **WEB MINING APPLICATIONS AND OTHER TOPICS** 9

Data integration for e-commerce - Web personalization and recommender systems - Web content and structure mining - Web data warehousing - Review of tools, applications, and systems.

TOTAL : 45

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REFERENCE BOOK				
Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Michael Berry and Gordon Linoff, John Wiley	Data Mining Techniques for Marketing, Sales, and Customer Relationship Management	Second Edition	2004
2.	Ralph Kimball and Richard Merz,	The Data Web house Toolkit	John Wiley	2000
3.	RajkumarBuyya,	Mining the Web: Transforming Customer Data into Customer Value	Tata McGraw Hill Edition	2013
4.	Gordon Linoff and Michael Berry	Hadoop: The Definitive Guide	John Wiley & Sons	2001

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21CSC04 **WEB ANALYTICS AND DEVELOPMENT**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. The course explores use of social network analysis
2. To understand growing connectivity and complexity in the world ranging from small groups to WWW
3. Apply various web search Techniques in Real time problems
4. Analyze the Random Graphs and Network evolution
5. Implement the Robustness Social involvements

COURSE OUTCOMES

21CSC04.CO1 Gain the knowledge of Social network and Web data
21CSC04.CO2 Familiar with web analytics tools and development
21CSC04.CO3 Illustrate Web Search and Retrieval techniques
21CSC04.CO4 Identify the Affiliation and identity of social connects
21CSC04.CO5 Aware the robustness in social involvements and diffusion of innovation

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC04.CO1	x	x	x	-	-	-	-	-	x	-	-	-	x	-	-
21CSC04.CO2	x	x	x	-	x	-	-	-	-	-	x	-	-	x	-
21CSC04.CO3	x	x	-	-	x	-	-	-	-	-	x	-	x	-	-
21CSC04.CO4	x	x	-	x	-	-	x	-	-	-	-	x	-	x	-
21CSC04.CO5	x	x	-	-	x	-	-	-	x	-	-	-	-	-	x

UNIT I **INTRODUCTION** 9

Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization.

UNIT II **WEB ANALYTICS TOOLS** 9

Click Stream Analysis, A/B testing, Online Surveys.

UNIT III **WEB SEARCH AND RETRIEVAL** 9

Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models

UNIT IV **MAKING CONNECTION** 9

Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity.

UNIT V **CONNECTION** 9

Connection Search, Collapse, Robustness Social involvements and diffusion of innovation.

TOTAL : L : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Hansen, Derek, Ben Sheiderman, Marc Smith	Analyzing Social Media Networks with NodeXL: Insights from a Connected World.	Morgan Kaufmann	2011
2.	Avinash Kaushik	Web Analytics 2.0: The Art of Online Accountability	Sybex	2009
3.	Easley, D. & Kleinberg, J.	Networks, Crowds, and Markets: Reasoning About a Highly Connected World.	New York: Cambridge University Press	2010
4.	Wasserman, S. & Faust, K.	Social network analysis: Methods and applications	New York: Cambridge University Press	1994
5.	P. R. & Contractor, N. S.	Theories of communication networks	New York: Oxford University Press.	2003

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21CSC05	DATA STORAGE TECHNOLOGIES AND NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To provide learners with a basic understanding of Enterprise Data Storage and Management Technologies
2. To explain the design of a data center and storage requirements
3. To discuss the various types of storage and their properties
4. To explain physical and virtualization of storage
5. To explain the backup, archiving with regard to recovery and business continuity

COURSE OUTCOMES

21CSC05.CO1 Learn Storage System Architecture
21CSC05.CO2 Overview of Virtualization Technologies, Storage Area Network
21CSC05.CO3 Analyze different aspects of data storage.
21CSC05.CO4 Apply many transformations in terms of techniques and hardware used for the same.
21CSC05.CO5 Describe Storage Area Networks And Storage QOS

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC05.CO1	-	x	-	-	X	-	-	-	-	-	-	x	-	x	-
21CSC05.CO2		-	x	x	-	x	-	x	-	-	x	-	-	-	X
21CSC05.CO3	x	-	-	-	-	-	x	-	-	-	x	-	X	-	x
21CSC05.CO4		x		x	-	-	-	-	-	-	-	X		-	-
21CSC05.CO5	x	x	x	-	-	-	-	-	x	x	-	-	x	-	-

UNIT I STORAGE MEDIA AND TECHNOLOGIES 9

Storage Media and Technologies -Magnetic, Optical and Semiconductor Media, Techniques for read/write Operations, Issues and Limitations.

UNIT II USAGE AND ACCESS 9

Usage and Access -Positioning in the Memory Hierarchy, Hardware and Software Design for Access, Performance issues.

UNIT III LARGE STORAGES 9

Large Storages -Hard Disks, Networked Attached Storage, Scalability issues, Networking issues.

UNIT IV STORAGE ARCHITECTURE SYSTEMS 9

Storage Architecture - Storage Partitioning, Storage System Design, Caching, Legacy Systems.

UNIT V STORAGE AREA NETWORKS AND STORAGE QOS 9

Storage Area Networks – Hardware and Software Components, Storage Clusters/Grids. Storage QoS– Performance, Reliability, and Security issues.

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REFERENCE BOOK				
Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Franklyn E. Dailey	The Complete Guide to Data Storage Technologies for Network-centric Computing-Paperback	Computer Technology Research Corporation	1998
2.	Nigel Poulton	Data Storage Networking : Real World Skills for the CompTIA Storage	Sybex	2014

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21CSC06 **PATTERN CLASSIFICATION AND ANALYSIS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To Study the fundamental algorithms for pattern recognition.
2. To instigate the various Pattern classification techniques.
3. To originate the various structural pattern recognition and feature extraction techniques
4. To understand the clustering concepts
5. To learn the recent advances in neural networks.

COURSE OUTCOMES

21CSC06.CO1 Understand and apply various algorithms for pattern recognition.
21CSC06.CO2 Realize the clustering concepts and algorithms.
21CSC06.CO3 Bring out feature extraction techniques
21CSC06.CO4 Easily understand the concept of fundamental algorithms for pattern recognition.
21CSC06.CO5 Analyze the recent advances in neural networks.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC06.CO1	x	x	x	x	-	-	-	-	-	-	-	-	x	-	x
21CSC06.CO2	x	x	x	x	-	-	-	-	-	-	x	-	-	x	-
21CSC06.CO3	x	x	x	-	-	-	-	-	-	-	x	-	x	-	-
21CSC06.CO4	x	x	x	x	x	-	-	-	-	-	-	x	-	-	x
21CSC06.CO5	x	x	x	-	-	-	-	-	-	-	-	x	x	-	-

UNIT I **PATTERN CLASSIFIER** 9

Overview of pattern recognition - Discriminant functions - Supervised learning - Parametric estimation Maximum likelihood estimation - Bayesian parameter estimation - Perceptron algorithm - LMSE algorithm - Problems with Bayes approach - Pattern classification by distance functions - Minimum distance pattern classifier.

UNIT II **UNSUPERVISED CLASSIFICATION** 9

Clustering for unsupervised learning and classification - Clustering concept - C-means algorithm – Hierarchical clustering procedures - Graph theoretic approach to pattern clustering - Validity of clustering solutions.

UNIT III **STRUCTURAL PATTERN RECOGNITION** 9

Elements of formal grammars - String generation as pattern description - Recognition of syntactic description -Parsing - Stochastic grammars and applications - Graph based structural representation.

UNIT IV **FEATURE EXTRACTION AND SELECTION** 9

Entropy minimization - Karhunen - Loeve transformation - Feature selection through functions approximation -Binary feature selection.

UNIT V **RECENT ADVANCES** 9

Neural network structures for pattern recognition - Neural network based pattern associators – Unsupervised learning in neural pattern recognition - Self organizing networks - Fuzzy logic - Fuzzy pattern classifiers –Pattern classification using Genetic Algorithms. STATE OF ART (Not for Exam) Image Transforms: DFT, DCT, Haar,SVD and KL- Introduction to Matlab Toolbox.

TOTAL : L : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Robert J.Schalkoff, Pattern Recognition	Statistical, Structural and Neural	John Wiley &Sons Inc., New York	2007.
2.	Tou and Gonzales	Pattern Recognition Principles	Wesley Publication Company, London	2008
3.	Duda R.O., and Hart.P.E	Pattern Classification and Scene Analysis	Wiley, New York	2009
4.	Morton Nadier and Eric Smith P	Pattern Recognition Engineering	John Wiley & Sons, New York	2009
5.	LFD Costa, RM Cesar Jr	Shape analysis and classification: theory and practice	ACM Digital Library	2011

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21CSC07 MOBILE AND PERVASIVE COMPUTING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To learn the basic architecture and concepts till Third Generation Communication systems
2. To understand the latest 4G Telecommunication System Principles
3. To introduce the broad perspective of pervasive concepts and management
4. To explore the HCI concepts in Pervasive environment
5. To apply the pervasive concepts in mobile environment

COURSE OUTCOMES

21CSC07.CO1	Obtain a thorough understanding of basic architecture and concepts of till Third Generation Communication systems
21CSC07.CO2	Explain the latest 4G Telecommunication System Principles
21CSC07 CO3	Incorporate the pervasive concepts
21CSC07.CO4	Implement the HCI in Pervasive environment
21CSC07.CO5	Work on the pervasive concepts in mobile environment

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC07.CO1	x	-	x	x	-	-	-	-	x	-	-	-	x	-	-
21CSC07.CO2	-	-	x	x	-	-	-	-	-	-	x	x	-	x	-
21CSC07.CO3	-	x	-	x	-	-	x	-	-	-	-	-	x	-	x
21CSC07.CO4	x	x	-	-	x	-	-	-	-	-	x	-	-	x	-
21CSC07.CO5	x	-	x	-	-	-	x	-	-	-	-	-	x	-	x

UNIT I INTRODUCTION 9

History – Wireless communications: GSM – DECT – TETRA – UMTS – IMT – 2000 – Blue tooth, WiFi, WiMAX, 3G ,WATM.- Mobile IP protocols -WAP push architecture-Wml scripts and appiications. Data networks – SMS – GPRS – EDGE – Hybrid Wireless100 Networks – ATM – Wireless ATM.

UNIT II OVERVIEW OF A MODERN 4G TELECOMMUNICATIONS SYSTEM 9

Introduction. LTE-A System Architecture. LTE RAN. OFDM Air Interface. Evolved Packet Core. LTE Requirements. LTE-Advanced. LTE-A in Release. OFDMA – Introduction. OFDM Principles. LTE Uplink—SC-FDMA. Summary of OFDMA.

UNIT III PERVASIVE CONCEPTS AND ELEMENTS 9

Technology Trend Overview - Pervasive Computing: Concepts - Challenges - Middleware - Context Awareness - Resource Management - Human–Computer Interaction - Pervasive Transaction Processing - Infrastructure and Devices - Wireless Networks - Middleware for Pervasive Computing Systems - Resource Management - User Tracking- Context Management -Service Management - Data Management - Security Management - Pervasive Computing Environments - Smart Car Space - Intelligent Campus .

UNIT IV HCI IN PERVASIVE COMPUTING 9

Prototype for Application Migration - Prototype for Multimodalities - Human–Computer Interface in Pervasive Environments - HCI Service and Interaction Migration - Context-Driven HCI Service Selection - Interaction Service Selection Overview - User Devices - Service-Oriented Middleware Support - User History and Preference - Context Manager - Local Service Matching - Global Combination - Effective Region - User Active Scope - Service Combination Selection Algorithm.

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UNIT V **PERVASIVE MOBILE TRANSACTIONS** **9**

Pervasive Mobile Transactions - Introduction to Pervasive Transactions - Mobile Transaction Framework - Unavailable Transaction Service - Pervasive Transaction Processing Framework - Context-Aware Pervasive Transaction Model - Context Model for Pervasive Transaction Processing - Context-Aware Pervasive Transaction Model - A Case of Pervasive Transactions - Dynamic Transaction Management - Context-Aware Transaction Coordination Mechanism - Coordination Algorithm for Pervasive Transactions - Participant Discovery - Formal Transaction Verification - Petri Net with Selective Transition.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1	Alan Colman, Jun Han, and Muhammad Ashad Kabir	Pervasive Social Computing Socially-Aware Pervasive Systems and Mobile Applications	Springer	2016
2	J.Schiller	Mobile Communication	Addison Wesley	2000
3	Juha Korhonen	Introduction to 4G Mobile Communications	Artech House Publishers	2014

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21CSC08	AD HOC AND WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To learn the basics of sensor networks.
2. To impart knowledge on the design and development of the data link and network layers in the WSN protocol stack.
3. To understand the working of protocols in different layers of sensor networks.
4. To learn the establishment of wireless sensor networks.
5. To familiarize the students with the hardware and software platforms used in the design of WSN.

COURSE OUTCOMES

21CSC08.CO1	Ability to learn the basics of sensor networks.
21CSC08.CO2	To impart knowledge on the design and development of the data link and network layers in the WSN protocol stack.
21CSC08.CO3	Analyze the working of protocols in different layers of sensor networks.
21CSC08.CO4	To learn the establishment of wireless sensor networks.
21CSC08.CO5	Analyze to understand the hardware

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC08.CO1	x	-	x	-	-	x	-	x	x	-	x	-	-	x	-
21CSC08.CO2	-	-	x	x	-	-	-	-		-	x	-	x	x	x
21CSC08.CO3	x	x	-	-	x	-	x	-	x	x	-	-	-	x	-
21CSC08.CO4	x	x	-	x	-	-		-	x	-	x	x	x	x	x
21CSC08.CO5	x	-	x	-	-	x	-	x	-	x	-	x	-	-	x

UNIT I **AD-HOC MAC** **9**

Introduction - Issues in Ad-Hoc Wireless Networks. MAC Protocols - Issues, Classifications of MAC protocols, Multi channel MAC & Power control MAC protocol.

UNIT II **AD-HOC NETWORK ROUTING & TCP** **9**

Issues - Classifications of routing protocols - Hierarchical and Power aware. Multicast routing - Classifications, Tree based, Mesh based. Ad Hoc Transport Layer Issues. TCP Over Ad Hoc - Feedback based, TCP with explicit link, TCP-BuS, Ad Hoc TCP, and Split TCP.

UNIT III **WSN –MAC** **9**

Introduction - Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols - self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

UNIT IV **WSN ROUTING, LOCALIZATION & QOS** **9**

Issues in WSN routing - OLSR, AODV. Localization - Indoor and Sensor Network Localization. QoS in WSN.

UNIT V **MESH NETWORKS** **9**

Necessity for Mesh Networks - MAC enhancements- IEEE802.11s Architecture- Opportunistic routing - Self configuration and Auto configuration - Capacity Models - Fairness - Heterogeneous Mesh Networks - Vehicular Mesh Networks.

TOTAL : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	C.Siva Ram Murthy and B.Smanoj	Ad Hoc Wireless Networks - Architectures and Protocols	Pearson Education	2004
2.	Feng Zhao and Leonidas Guibas	Wireless Sensor Networks	Morgan Kaufman Publishers	2004
3.	C.K.Toh	Ad Hoc Mobile Wireless Networks	Pearson Education	2002

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21CSC09	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To get acquainted with the building blocks of Internet of Things (IoTs), characteristics and taxonomy of IoT levels.
2. To learn a generic design methodology
3. To learn a programming aspects of IoT.
4. To know about various packages, frameworks and cloud services.
5. To get acquainted with data analytics for IoT.

COURSE OUTCOMES

21CSC09.CO1 Identify and design the new models for market strategic interaction.
21CSC09.CO2 Design business intelligence and information security for WoB.
21CSC09.CO3 Analyze various protocols for IoT.
21CSC09.CO4 Analyze programming aspects of IoT.
21CSC09.CO5 To know about various packages, frameworks and cloud services.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC09.CO1	x	-	x	-	x	-	-	x	-	x	-	x	x	x	-
21CSC09.CO2	x	x	-	-	x	-	-	x	x	x	-	-	x	-	-
21CSC09.CO3	x	x	x	x	-	x	-	-	x	x	x	x	-	x	-
21CSC09.CO4	x	x	x	x	-	x	-	-	x	x	x	-	x	-	x
21CSC09.CO5	x	x	x	x	-	x	-	-	x	x	x	x	x	x	-

UNIT I **INTRODUCTION TO IoT** 9

Definition and Characteristics – Physical Design Things – Protocols - Logical Design – Functional Blocks – Communication Models – Communication APIs – Introduction to measure the physical quantities – IoT Enabling Technologies – Wireless Sensor Networks - Cloud Computing – Big Data Analytics – Communication Protocols – Embedded Systems – IoT Levels and Deployment Templates.

UNIT II **DEVELOPING INTERNET OF THINGS** 9

Introduction to Smart Systems using IoT – IoT Design Methodology – Case Study: Weather Monitoring – Logical Design using Python – Data types & Data Structures – Control Flow – Functions – Modules – Packages – File Handling – Date/Time Operations – Classes – Python Packages of Interest for IoT.

UNIT III **DOMAIN SPECIFIC IoTs** 9

Home Automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Lifestyle – IoT and M2M.

UNIT IV **IoT PHYSICAL DEVICES, ENDPOINTS AND CLOUD OFFERINGS** 9

IoT Device – Raspberry Pi – Interfaces – Programming Raspberry Pi with Python – Other IoT Devices – IoT Physical Servers and Cloud Offerings – Cloud Storage Models and communication APIs – WAMP – Xively Cloud – Django – Amazon Web Services for IoT – SkyNet IoT Messaging Platform – Basics of Secure IoT Programming – Case Study: Home Automation.

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UNIT V **DATA ANLYTICS FOR IoT** 9

Introduction – Apache Hadoop –Using Hadoop MapReduce for Batch Data Analysis –Apache Oozie – Apache Spark – Apache Strom – Using Apache Strom for Real-time Data Analysis – Case Study: Structural Health Monitoring.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Arshadeep Bahga, Vijay Madisetti	Internet of Things: A Hands-On Approach	Published by Arshdeep Bahga & Vijay Madisetti	2014
2.	Mike Kuniavsky	Smart Things: Ubiquitous Computing User Experience Design	Morgan Kaufmann Publishers	2010
3.	Wimer Hazenberg	Meta Products: Building the Internet of Things. Sara Cordoba	Menno Huisman BIS Publishers	2011
4.	Massimo Banzi	Getting Started with Arduino (Make: Projects).	O'Reilly Media	2008
5.	*Barnaghi*	Semantics for the Internet of things	Addison Wesley	2012

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21CSC10	INTERNET OF THINGS LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To study the assembly language using simulator and kit.
2. To implement ALU operations.
3. To generate waveforms and test timers
4. To develop applications using Embedded C language.
5. To design IoT applications using Aurdino, Raspberry Pi, and Bluemix.

COURSE OUTCOMES

21CSC10.CO1	Execute Assembly Language experiments using simulator.
21CSC10.CO2	Implement ALU operations.
21CSC10.CO3	Design waveforms and test timers.
21CSC10.CO4	Develop real time applications and explore ARM/PIC using Embedded C.
21CSC10.CO5	Demonstrate real time applications using Aurdino, Raspberry Pi, and Bluemix..

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC10.CO1	x	-	x	x	-	-	x	-	-	x	-	x	x	x	-
21CSC10.CO2	x	x	-	-	x	-	x	x	x	x	-	-	x	-	-
21CSC10.CO3	x	x	x	x	-	x	-	-	x	x	x	x	x	-	-
21CSC10.CO4	x	x	x	-	x	x	-	x	x	x	x	-	-	-	x
21CSC10.CO5	x	x	x	x	-	x	-	-	x	x	x	x	x	x	-

Sl.No	List of Experiments
1.	Write Basic and arithmetic Programs Using Embedded C.
2.	Write Embedded C program to test interrupt and timers.
3.	Develop Real time applications – clock generation, wave form generation, counter using embedded C.
4.	Explore ARM/PIC based controllers using Embedded C.
5.	Explore different communication methods with IoT devices
6	Develop simple application – testing infrared sensor – IoT Applications – using Aurdino.
7	Develop simple application – testing temperature, light sensor – IOT Application using open platform/Raspberry Pi.
8	Deploy IOT applications using platforms such as Bluemix.

TOTAL : P : 30

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21CSC11 **DATA PREPARATION AND ANALYSIS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To prepare the data for analysis
2. To develop meaningful Data
3. Learn the different ways of Data Analysis
4. Be familiar with data streams
5. Be familiar with the visualization

COURSE OUTCOMES

21CSC11.CO1	Work in a business environment in which data preparation occurs.
21CSC11.CO2	Apply data cleaning techniques on real world data and prepare data for analysis
21CSC11.CO3	Perform exploratory analysis on data, such as calculating descriptive and comparative statistics
21CSC11.CO4	Experiment visualization techniques for various data analysis tasks
21CSC11.CO5	Illustrate Clustering and association techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC11.CO1	x	-	-	x	-	-	x	-	-	-	x	-	x	-	-
21CSC11.CO2	-	-	x	x	x	-	-	-	-	-	-	x	-	x	-
21CSC11.CO3	-	x	-	-	-	-	-	-	-	-	x	x	x	-	x
21CSC11.CO4	x	x	-	-	x	-	-	-	-	x	-	-	-	x	-
21CSC11.CO5	x	-	x	-	-	x	-	-	-	-	x	-	x	-	-

UNIT I **DATA GATHERING AND PREPARATION** 9

Defining Data analysis problems: Knowing the client-understanding the questions- Data Gathering and Preparation: Data formats-parsing and transformation-Scalability and real-time issues

UNIT II **DATA CLEANING** 9

Data Cleaning: Consistency checking-Heterogeneous and missing data- Data Transformation and segmentation.

UNIT III **EXPLORATORY ANALYSIS** 9

Exploratory Analysis: Descriptive and comparative statistics- Clustering and association-Hypothesis Generation

UNIT IV **VISUALIZATION** 9

Visualization: Designing visualizations- Time series-Geolocated data- Correlations and connections-Hierarchies and networks- interactivity.

UNIT V **STATISTICS** 9

Descriptive statistics-Inferential statistics-Comaparative statistics

TOTAL : L : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Glenn J. Myatt	Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining	John Wiley & Sons, Inc Second edition	2014
2.	Michael Berthold, David J. Hand	Intelligent Data Analysis	Springer	2007
3.	Donald J. Wheeler	Making Sense of Data	SPC Press	2003
4.	Dorian Pyle	Data Preparation for Data Mining	Morgan Kaufmann	1999
5.	Gerhard Svolba	Data Preparation for Analytics Using SAS	SAS Institute	2006

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21CSC12 ADVANCED COMPUTER ARCHITECTURE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To analyze various performance related parameters in computer architecture and understand instruction set architectures
2. To understand Instruction Level Parallelism(ILP) with its limitations
3. To utilize the ILP concept for memory design
4. To review various issues in multiprocessor
5. To understand the design of the memory hierarchy and analyze the types of multiprocessors

COURSE OUTCOMES

21CSC12.CO1	Understand performance related parameters and the concepts of Instruction Set architectures
21CSC12.CO2	Describe Instruction Level parallelism and identify the limitations of ILP
21CSC12.CO3	Discuss the approaches of exposing and exploiting ILP
21CSC12.CO4	Design hierarchical memory System
21CSC12.CO5	Analyze the types of multiprocessor architecture and storage devices

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC12.CO1	x	-	x	-	x	-	-	-	x	-	-	-	x	-	-
21CSC12.CO2	x	x	-	-	-	x	x	-	-	-	-	-	-	x	-
21CSC12.CO3	-	-	x	-	x	-	-	x	-	x	-	-	x	-	-
21CSC12.CO4	-	-	x	x	-	-	-	-	-	-	x	x	-	x	-
21CSC12.CO5	-	x	x	-	x	-	-	-	x	-	-	-	-	-	x

UNIT I **FUNDAMENTALS OF COMPUTER DESIGN** 9

Introduction-measuring and reporting performance- Quantitative principles of computer design- Instruction set principles and examples- classifying instructions- set architectures-memory addressing- addressing modes for signal processing-type and size of operands.

UNIT II **INSTRUCTION LEVEL PARALLELISM** 9

Concepts and challenges – overcoming data hazards with dynamic scheduling – examples- reducing branch costs with dynamic hardware prediction- high performance instruction delivery- taking advantages of ILP with multiple issues-limitations of ILP.

UNIT III **ILP WITH SOFTWARE APPROACHES** 9

Basic compiler techniques for exposing ILP- static branch prediction- static multiple issues: VLIW approach- Advanced compiler support for exposing and exploiting ILP-Hardware support-cross cutting issues- Intel IA64 architecture.

UNIT IV **MEMORY HIERARCHY DESIGN** 9

Introduction- review of caches- cache performance- reducing cache miss penalty-reducing miss rate- miss rate via parallelism –reducing hit time – main memory and organizations for improving performance- memory technology- virtual memory.

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UNIT V **MULTIPROCESSORS AND THREAD LEVEL PARALLELISM** 9

Symmetric shared memory architectures-performance of symmetric shared memory multiprocessors – Distributed shared memory architectures-synchronization- storage systems – types of storage devices- buses- reliability-availability and dependability- RAID – errors and failures in real systems- I/O performance measures- Introduction to queuing theory.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John L. Hennessy and David A. Patterson	Computer Architecture: A Quantitative Approach	Morgan Kaufmann, 3rd Edition	2003
2.	Sima D. FountainT. And Kacsuk P	Advanced Computer Architectures: A Design Space Approach	Addison Wesley	2000
3.	Kai Hwang	Advanced Computer Architecture: Parallelism, Scalability, Programmability	Tata McGraw Hill Edition	2001

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21CSC13	MULTICORE ARCHITECTURE	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the recent trends in the field of Computer Architecture and identify performance related parameters
2. To appreciate the need for parallel processing
3. To expose the students to the problems related to multiprocessing
4. To understand the different types of multicore architectures
5. To expose the students to warehouse-scale and embedded architectures

COURSE OUTCOMES

21CSC13.CO1	Identify the limitations of ILP and the need for multicore architectures
21CSC13.CO2	Point out the salient features of different multicore architectures and how they exploit parallelism.
21CSC13.CO3	Expose the different multiprocessor issues.
21CSC13.CO4	Discuss the warehouse-scale computers architectures
21CSC13.CO5	Build the Requirements of Embedded Systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC13.CO1	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
21CSC13.CO2	x	-	x	x	-	-	-	x	-	-	x	-	-	x	-
21CSC13.CO3	x	x	x	-	-	-	x	-	-	-	x	-	x	-	x
21CSC13.CO4	x	x	x	-	x	-	-	-	-	-	-	x	-	x	-
21CSC13.CO5	x	x	x	-	-	-	-	-	x	x	-	-	x	-	-

UNIT I **FUNDAMENTALS OF QUANTITATIVE DESIGN AND ANALYSIS** 9

Classes of Computers – Trends in Technology, Power, Energy and Cost – Dependability – Measuring, Reporting and Summarizing Performance – Quantitative Principles of Computer Design – Classes of Parallelism - ILP, DLP, TLP and RLP.

UNIT II **DLP IN VECTOR, SIMD AND GPU ARCHITECTURES** 9

Vector Architecture - SIMD Instruction Set Extensions for Multimedia – Graphics Processing Units - Detecting and Enhancing Loop Level Parallelism.

UNIT III **TLP AND MULTIPROCESSORS** 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 **WAREHOUSE-SCALE ARCHITECTURES** 9

Programming Models and Workloads for Warehouse-Scale Computers – Architectures for Warehouse-Scale Computing – Physical Infrastructure and Costs – Cloud Computing – Case Studies.

UNIT V **ARCHITECTURES FOR EMBEDDED SYSTEMS** 9

Features and Requirements of Embedded Systems – Signal Processing and Embedded Applications – The Digital Signal Processor – Embedded Multiprocessors.

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	John L. Hennessey and David A. Patterson	"Computer Architecture – A Quantitative Approach"	Morgan Kaufmann / Elsevier, 5th edition	2012
2.	Darryl Gove	"Multicore Application Programming for Windows, Linux, and Oracle Solaris"	Pearson	2011
3.	Richard Y. Kain,	"Advanced Computer Architecture a Systems Design Approach"	Prentice Hall	2011

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21CSC14 **WIRELESS SENSOR NETWORKS**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

1. To understand the working of protocols in different layers of sensor networks.
2. To learn the establishment of wireless sensor networks.
3. To familiarize the students with the hardware and software platforms used in the design of WSN.
4. To learn the establishment of wireless sensor networks.
5. To Analysis of various critical parameters in deploying a WSN

COURSE OUTCOMES

21CSC14.CO1	Ability to learn the basics of sensor networks.
21CSC14.CO2	To impart knowledge on the design and development of the data link and network layers in the WSN protocol stack.
21CSC14.CO3	Analyze the working of protocols in different layers of sensor networks.
21CSC14.CO4	Technical knowhow in building a WSN network.
21CSC14.CO5	Analyze to understand the hardware

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC14.CO1	-	x	x	-	x	-	-	-	-	-	-	x	-	x	-
21CSC14.CO2	-	-	x	x	-	x	-	x	-	-	x	-	-	x	-
21CSC14.CO3	x			-	-	-	x	-	-	-	x	-	x	-	x
21CSC14.CO4		x	x	x	-	-	-	-	-	-	-	-		-	-
21CSC14.CO5	x	x	x	-	-	-	-	-	x	x	-	-	x	-	-

UNIT I **Introduction** **9**

Fundamentals of wireless communication technology, the electromagnetic spectrum radio propagation, characteristics of wireless channels, modulation techniques, multiple access techniques, wireless LANs, PANs, WANs, and MANs, Wireless Internet.

UNIT II **WIRELESS SENSOR NETWORKS** **9**

Introduction - Sensor Network Architecture, Data dissemination, Gathering. MAC Protocols - self-organizing, Hybrid TDMA/FDMA and CSMA based MAC.

UNIT III **WSN- ROUTING** **9**

MAC Protocols : Issues in designing MAC protocols for adhoc wireless networks, design goals, classification of MAC protocols, MAC protocols for sensor network, location discovery, quality, other issues, S-MAC, IEEE 802.15.4.

UNIT IV **QoS and Energy Management** **9**

Issues and Challenges in providing QoS, classifications, MAC, network layer solutions, QoS frameworks, need for energy management, classification, battery, transmission power, and system power management schemes.

UNIT V **WSN LOCALIZATION & QOS** **9**

Issues in WSN routing - OLSR, AODV. Localization - Indoor and Sensor Network Localization. QoS in WSN.

TOTAL: L : 45

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REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Feng Zhao and Leonidas Guibas	Wireless Sensor Networks	Morgan Kaufman Publishers	2004
2.	William Stallings	Wireless Communications and Networks	Pearson Education	2004
3.	C.Siva Ram Murthy and B.Smanoj	Ad Hoc Wireless Networks - Architectures and Protocols	Pearson Education	2004

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21CSC15	COMPUTER VISION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To review image processing techniques for computer vision.
2. To understand shape and region analysis.
3. To understand Hough Transform and its applications to detect lines
4. To understand motion analysis.
5. To study some applications of computer vision algorithms

COURSE OUTCOMES

21CSC15.CO1 Implement fundamental image processing techniques required for computer vision.
21CSC15.CO2 Perform shape analysis
21CSC15.CO3 Apply Hough Transform for line, circle, and ellipse detections
21CSC15.CO4 Implement motion related techniques.
21CSC15.CO5 Develop applications using computer vision techniques

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSC15.CO1	x	x	x	-	x	-	-	-	-	-	-	x	-	x	-
21CSC15.CO2	x	-	x	x	-	x	-	x	-	-	x	-	-	x	-
21CSC15.CO3	x	x	x	-	-	-	x	-	-	-	x	-	x	-	x
21CSC15.CO4	x	x	x	x	-	-	-	-	-	-	-	-	x	-	-
21CSC15.CO5	x	x	x	-	-	-	-	-	x	x	-	-	x	-	-

UNIT I **IMAGE PROCESSING FOUNDATIONS** **9**

Review of image processing techniques – classical filtering operations – thresholding techniques – edge detection techniques – corner and interest point detection – mathematical morphology – texture.

UNIT II **SHAPES AND REGIONS** **9**

Binary shape analysis – connectedness – object labeling and counting – size filtering – distance functions – skeletons and thinning – deformable shape analysis – boundary tracking procedures – active contours – shape models and shape recognition – centroidal profiles – handling occlusion – boundary length measures – boundary descriptors – chain codes – Fourier descriptors – region descriptors – moments.

UNIT III **HOUGH TRANSFORM** **9**

Line detection – Hough Transform (HT) for line detection – foot-of-normal method – line localization – line fitting – RANSAC for straight line detection – HT based circular object detection – accurate center location – speed problem – ellipse detection – Case study: Human Iris location – hole detection – generalized Hough Transform (GHT).

UNIT IV **3D VISION AND MOTION** **9**

from texture – shape from focus – active range finding – surface representations – point-based representation – volumetric representations – 3D object recognition – 3D reconstruction – introduction to motion- – layered motion.

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UNIT V **APPLICATIONS** **9**

Application: Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models faces - Application: In-vehicle vision system: locating roadway – road markings – identifying road signs – locating pedestrians- Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion.

TOTAL : L : 45

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	D. L. Baggio et al	Mastering OpenCV with Practical Computer Vision Projects	Packt Publishing,	2012
2.	Mark Nixon and Alberto S. Aquado	Feature Extraction & Image Processing for Computer Vision	Third Edition, Academic Press	2012
3.	R. Szeliski	Computer Vision: Algorithms and Applications	Springer	2011

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Programme Code & Name: MC & M.E-Computer Science and Engineering

21CSD04 **VALUE EDUCATION**

L	T	P	C
2	0	0	2

COURSE OBJECTIVES

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character
4. To teach and inculcate the importance of value based living.
5. To give students a deeper understanding about the purpose of life.

COURSE OUTCOMES

21CSD04.CO1 Knowledge of self-development
21CSD04.CO2 Learn the importance of Human values
21CSD04.CO3 Developing the overall personality
21CSD04.CO4 Infer the importance of behavior development.
21CSD04.CO5 Know the self-management and good health

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSD04.CO1	-	-	-	-	-	x	x	x	-	x	-	x	-	-	-
21CSD04.CO2	-	-	-	-	-	x	x	x	-	x	x	-	-	x	-
21CSD04.CO3	-	-	-	-	-	x	x	x	x	x	x	-	-	-	-
21CSD04.CO4	-	-	-	-	-	x	x	x	-	x	-	x	-	-	-
21CSD04.CO5	-	-	-	-	-	x	x	x	-	x	-	x	-	-	-

UNiT I **VALUES AND SELF-DEVELOPMENT** 5

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** 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 : L : 25

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Programme Code & Name: MC & M.E-Computer Science and Engineering

Reference Books:				
Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
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 University Press, New Delhi	1998

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Programme Code & Name: MC & M.E-Computer Science and Engineering

21CSD05	DISASTER MANAGEMENT	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. Critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country.

COURSE OUTCOMES

21CSD05.CO1	Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
21CSD05.CO2	Realize critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
21CSD05.CO3	Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
21CSD05.CO4	Understand the strengths and weaknesses of disaster management approaches, planning and Programming in different countries, particularly their home country.
21CSD05.CO5	Gain Knowledge in emerging trend mitigation of disasters.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21CSD05.CO1	x	-	x	x	x	-	x	-	-	x	-	-	x	-	-
21CSD05.CO2	x	x	x	x	-	x	-	x	-	-	x	-	-	x	-
21CSD05.CO3	x	x	-	-	-	x	-	x	-	x	x	-	x	-	-
21CSD05.CO4	x	-	x	-	x	-	-	-	-	-	-	x	-	x	-
21CSD05.CO5	x	x	x	-	x	-	x	x	-	-	-	-	x	-	-

UNIT I **INTRODUCTION** 5

Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II **REPERCUSSIONS OF DISASTERS AND HAZARDS** 5

Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease And Epidemics, War And Conflicts.

UNIT III **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.

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UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT 5

Preparedness: Monitoring of Phenomena Triggering A Disaster Or Hazard; Evaluation of Risk: Application of Remote Sensing.

UNIT V 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'sParticipation in Risk Assessment. Strategies for Survival.

TOTAL : L : 25

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	R. Nishith, Singh AK	Disaster Management in India: Perspectives, issues and strategies	New Royal book Company	-
2.	Sahni, Pardeep et.al. (Eds.)	Disaster Mitigation Experiences And Reflections	Prentice Hall Of India, New Delhi	-
3.	Goel S. L	Disaster Administration And Management Text And Case Studies	Deep & Deep Publication Pvt. Ltd, New Delhi	-

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