



FRANCIS XAVIERTM
ENGINEERING COLLEGE
AN AUTONOMOUS INSTITUTION

Accredited BY NBA | AICTE Sponsored Margdarshan Mentor Institution
DST-FIST Supported Institution | ISO 9001:2015 Certified
Recognized under Section 2(f) & 12(B) of the UGC Act, 1950

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CURRICULUM AND SYLLABI

Choice Based Credit System

Regulations 2021

M.Tech – Information Technology

Department Vision

To attain global recognition in Information Technology education and training and to meet the growing needs of the industry and society.

Department Mission

* Imparting quality education for the challenging needs of the IT industry with ethics and to reach the unreached through technological development. * Promote new uses of Information Technology within the institution through the support for exploratory and innovative applications

DEPARTMENT OF INFORMATION
TECHNOLOGY

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PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

1. To enable graduates to excel professionally by adapting to the dynamic needs of the industry, academia and research in the field of Information Technology.
2. To enable graduates to practice and promote information technologies for societal needs.
3. To enable graduates to contribute to advancement of information technology by means of research and lifelong learning.

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

b. 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.

c. 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.

d. 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.

e. 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.

f. 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.

g. 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.

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

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

j. 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. To analyze, design and develop applications relevant to the industrial needs.
2. To apply software engineering principles and practices for developing quality software for scientific and business applications.
3. To develop programs related to IT services based on open source technologies.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES WITH PROGRAMME OUTCOMES

A broad relation between the programme objective and the outcomes is given in the following table

PROGRAMME EDUCATIONAL OBJECTIVES(PEO)	PROGRAMME OUTCOMES (PO)									
	a	b	c	D	e	f	g	h	i	j
PEO 1	M	H	M	H				L	L	M
PEO 2	H				H		M		L	L
PEO 3		H		M	M	M	M	H	M	

Contribution L: Low / Reasonable M: Medium / Significant H:High / Strong

**M.TECH INFORMATION TECHNOLOGY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
I – IV SEMESTERS CURRICULUM**

SUMMARY OF CREDIT DISTRIBUTION

S. No	CATEGORY	CREDITS PER SEMESTER				TOTAL CREDITS	CREDITS IN %
		I	II	III	IV		
1	FC	4				4	6%
2	PC	20	14			34	47%
3	PE		6	9		15	21%
4	EEC		1	6	12	19	26%
TOTAL		24	21	15	12	72	

- FC - Foundation Course
- PC - Professional Core
- PE - Professional Elective
- EEC - Employability Enhancement Course

**M.TECH INFORMATION TECHNOLOGY
REGULATIONS 2021
CHOICE BASED CREDIT SYSTEM
I – IV SEMESTERS CURRICULUM**

FIRST SEMESTER							
Code No.	Course	Category	L	T	P	C	H
Theory Courses							
21MA1254	Advanced Matrix Theory and Estimation for Engineers	FC	3	1	0	4	4
21IF1601	Advanced Data Structures and Algorithm Design Techniques	PC	3	1	0	4	4
21IF1602	Advanced Computer Architecture	PC	3	0	0	3	3
21IF1603	Modern Operating System	PC	3	0	0	3	3
21IF1604	Software Engineering and Project Management	PC	3	0	0	3	3
21IF1605	Advanced Database technology	PC	3	0	0	3	3
Practical Courses							
21IF1611	Advanced Data Structures Laboratory	PC	0	0	2	2	4
21IF1612	Advanced Database Technology Laboratory	PC	0	0	2	2	4
TOTAL			18	2	4	24	28

SECOND SEMESTER							
Code No.	Course	Category	L	T	P	C	H
Theory Courses							
21IF2601	Machine Learning Techniques	PC	3	0	0	3	3
21IF2602	Advanced Network Security	PC	3	0	0	3	3
21IF2603	Internet of Things	PC	3	0	0	3	3
21IF2604	Big Data Analytics	PC	3	0	0	3	3
	Professional Elective-I	PE	3	0	0	3	3
	Professional Elective -II	PE	3	0	0	3	3
Practical Courses							
21IF2911	Technical Paper Writing and Seminar	EEC	0	0	1	1	2
21IF2611	Data Analytics Laboratory	PC	0	0	4	2	4
TOTAL			18	0	5	21	24

THIRD SEMESTER								
Code No.	Course	Category	L	T	P	C	H	
Theory Courses								
	Professional Elective – III	PE	3	0	0	3	3	
	Professional Elective – IV	PE	3	0	0	3	3	
	Professional Elective – V	PE	3	0	0	3	3	
Practical Courses								
21IF3911	Project Work Phase I	EEC	0	0	6	6	12	
TOTAL			9	0	6	15	21	

FOURTH SEMESTER								
Code No.	Course	Category	L	T	P	C	H	
Practical Courses								
21IF4911	Project Work Phase II	EEC	0	0	12	12	24	
			0	0	12	12	24	

TOTAL NO. OF CREDITS: 72

L Lecture
T Tutorial
P Practical
H Hours

Code No	Course	L	T	P	C	H
FOUNDATION COURSES (FC)						
21MA1254	Advanced Matrix Theory and Estimation for Engineers	3	1	0	4	4
LIST OF EMPLOYABILITY ENHANCEMENT COURSE (EEC)						
21IF2911	Technical Paper Writing and Seminar	0	0	1	1	2
21IF3911	Project Work Phase I	0	0	6	6	12
21IF4911	Project Work Phase II	0	0	12	12	24
PROFESSIONAL ELECTIVES						
PROFESSIONAL ELECTIVE I						
21IF2701	Data and Cloud Security	3	0	0	3	3
21IF2702	Network and Wireless Security	3	0	0	3	3
21IF2703	Energy Aware Computing	3	0	0	3	3
21IF2704	Bio-Inspired Computing and Image Processing Applications	3	0	0	3	3
PROFESSIONAL ELECTIVE II						
21IF2705	Digital Image Processing and Pattern Recognition	3	0	0	3	3
21IF2706	Green Computing	3	0	0	3	3
21IF2707	Agent Based Intelligent System	3	0	0	3	3
21IF2708	Information Retrieval Techniques	3	0	0	3	3
PROFESSIONAL ELECTIVE III						
21IF3701	Social Network Analysis	3	0	0	3	3
21IF3702	Mobile Application Development	3	0	0	3	3
21IF3703	Video Analytics	3	0	0	3	3
21IF3704	Deep Learning	3	0	0	3	3
PROFESSIONAL ELECTIVE IV						
21IF3705	Automata Theory and Formal Languages	3	0	0	3	3
21IF3706	GPU Architecture and Programming	3	0	0	3	3
21IF3707	Cyber Laws and Security Policies	3	0	0	3	3
21IF3708	Trust Networks	3	0	0	3	3
PROFESSIONAL ELECTIVE V						
21IF3709	Wireless Ad hoc and Sensor Networks	3	0	0	3	3
21IF3710	Software Testing and Quality Assurance	3	0	0	3	3
21IF3711	Design Thinking	3	0	0	3	3
21IF3712	Forecasting and Optimization	3	0	0	3	3

21MA1254	ADVANCED MATRIX THEORY AND ESTIMATION FOR ENGINEERS	L	T	P	C
		3	1	0	4
Prerequisites for the course					
The students should have the basic knowledge on probability and random variables.					
Objectives					
This course is designed to provide the solid foundation on topics in applied probability and various statistical methods, which form the basis for many other are as in the mathematical sciences including statistics, modern optimization methods and risk modeling. It is framed to address the issues and the principles of estimation theory, testing of hypothesis and multivariate analysis.					
UNIT I	PROBABILITY AND RANDOM VARIABLES	12			
Probability–Axioms of probability – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions.					
UNIT II	TWO DIMENSIONAL RANDOM VARIABLES	12			
Joint distributions – Marginal and conditional distributions – Functions of two dimensional Random variables – Correlation.					
UNIT III	ESTIMATION THEORY	12			
Unbiased estimators – Method of moments – Maximum likelihood estimation – Curve fitting by principle of least squares – Regression lines.					
UNIT IV	TESTING OF HYPOTHESIS	12			
Sampling distributions – Type I and Type II errors – Small and large samples – 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.					
UNIT V	MULTIVARIATE ANALYSIS	12			
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 Periods					60
Suggestive Assessment Methods					
Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)			
<ul style="list-style-type: none"> Descriptive Questions 	<ul style="list-style-type: none"> Assignment Online Quizzes Problem-Solving Activities 	<ul style="list-style-type: none"> Descriptive Questions 			

Outcomes	
Upon completion of the course, the students will be able to:	
C101.1	Able to find the possibilities of happenings
C101.2	Analyze two dimensional random variables with the correlations
C101.3	Analyze and estimates the maximum likelihood
C101.4	Able to test the distributions for independence of attributes
C101.5	Analyze with the multivariate and principal components
Reference Books	
<ol style="list-style-type: none"> Devore, J.L., "Probability and Statistics for Engineering and the Sciences", 8th Edition, Cengage Learning, 2014. Dallas E. Johnson, "Applied Multivariate Methods for Data Analysis", Thomson and Duxbury press, 1998. Gupta S. C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan and Sons, New Delhi, 2001. Johnson, R.A., Miller, I and Freund J., "Miller and Freund" Probability and Statistics for Engineers", Pearson Education, Asia, 8thEdition, 2015. Richard A. Johnson and Dean W. Wichern, "Applied Multivariate Statistical Analysis", 5th Edition, Pearson Education, Asia, 2002. 	

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C101.1	3		3	3		3									
C101.2		2	1	1	2				2				3		
C101.3	1	1	2	2	1	1	1	3							
C101.4		2	1	2		1	3			1			2		
C101.5	1	2	2		1	2			3					1	

21IF1601	ADVANCED DATA STRUCTURES AND ALGORITHM DESIGN TECHNIQUES	L	T	P	C
		3	1	0	4
Prerequisites for the course					
The students should have the basic knowledge on Data structures and algorithms					
Objectives					
<ul style="list-style-type: none"> Understand the graph algorithms. Learn different algorithms analysis techniques. Apply data structures and algorithms in real time applications Able to analyze the efficiency of algorithm. Understand the NP Complete and NP Hard. 					
UNIT I	ROLE OF ALGORITHMS IN COMPUTING	12			
Algorithms – Algorithms as a Technology- Insertion Sort – Analyzing Algorithms – Designing Algorithms - Growth of Functions: Asymptotic Notation–Standard Notations and Common Functions - Recurrences: The Substitution Method–The Recursion-Tree Method.					
UNIT II	HIERARCHICAL DATA STRUCTURES	12			
Binary Search Trees: Basics – Querying a Binary search tree – Insertion and Deletion- Red-Black trees: Properties of Red-Black Trees – Rotations – Insertion – Deletion -B-Trees: Definition of B-trees – Basic operations on B-Trees – Deleting a key from a B-Tree- Fibonacci Heaps: structure – Merge-able-heap operations-Decreasing a key and deleting a node-Bounding the maximum degree.					
UNIT III	GRAPHS	12			
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search – Topological Sort – Strongly Connected Components- Minimum Spanning Trees: Growing a Minimum Spanning Tree – Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm–Single-Source Shortest path sin Directed Acyclic Graphs – Dijkstra’s Algorithm; All-Pairs Shortest Paths: Shortest Paths and Matrix Multiplication–The Floyd-Warshall Algorithm;					
UNIT IV	ALGORITHM DESIGN TECHNIQUES	12			
Dynamic Programming: Matrix – Chain Multiplication – Elements of Dynamic Programming – Longest Common Subsequence- Greedy Algorithms: An Activity-Selection Problem – Elements of the Greedy Strategy - Huffman Codes.					
UNIT V	NP COMPLETE AND NP HARD	12			
NP-Completeness: Polynomial Time – Polynomial – Time Verification – NP – Completeness and Reducibility – NP – Completeness Proofs – NP – Complete Problems					
Total Periods					60
Suggestive Assessment Methods					

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
1. Descriptive Questions 2. MCQ	MCQ, SEMINAR, ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course, the students will be able to:		
C102.1	Design data structures and algorithms to solve computing problems	
C102.2	Understand the necessary mathematical abstraction to solve problems.	
C102.3	Design algorithms using graph structure and various string matching algorithms to solve real-life problems	
C102.4	Apply suitable design strategy for problem solving, Comprehend and select algorithm design approaches in a problem specific manner.	
C102.5	Understand the awareness of NP completeness and randomized algorithms.	
Reference Books		
<ol style="list-style-type: none"> 1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006. 2. Robert Sedgwick and Kevin Wayne, "ALGORITHMS", Fourth Edition, Pearson Education. 3. S. Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014 4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011. 		

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C102.1		2	3	3	2							2			
C102.2	1	2	3	3	2									1	
C102.3	1	1	3	3	2	1								1	
C102.4		2	3	3	1		1					2			
C102.5	1	2	3	3	2	1									

21IF1602	ADVANCED COMPUTER ARCHITECTURE	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the basic knowledge on Computer Architecture					
Objectives					
<ol style="list-style-type: none"> 1. To introduce the students to the recent trends in the field of Computer Architecture and identify performance related parameters. 2. To learn the different multiprocessor issues. 3. To expose the different types of multicore architectures. 4. To understand the design of the memory hierarchy. 					
UNIT I	FUNDAMENTALS OF COMPUTER DESIGN AND ILP	12			
Fundamentals of Computer Design – Measuring and Reporting Performance – Instruction Level Parallelism and its Exploitation – Concepts and Challenges –Exposing ILP - Advanced Branch Prediction-Dynamic Scheduling-Hardware-Based Speculation-Exploiting ILP – Instruction Delivery and Speculation-Limitations of ILP–Multithreading					
UNIT II	MEMORY HIERARCHY DESIGN	12			
Introduction–Optimizations of Cache Performance – Memory Technology and Optimizations – Protection: Virtual Memory and Virtual Machines –Design of Memory Hierarchies – Case Studies.					
UNIT III	MULTIPROCESSOR ISSUES	12			
Introduction - Centralized, Symmetric and Distributed Shared Memory Architectures – Cache Coherence Issues – Performance Issues – Synchronization – Models of Memory Consistency – Case Study – Interconnection Networks – Buses, Crossbar and Multi-stage Interconnection Networks.					
UNIT IV	MULTICORE ARCHITECTURES	12			
Homogeneous and Heterogeneous Multi-core Architectures – Intel Multicore Architectures – SUN CMP architecture – IBM Cell Architecture. Introduction to Warehouse – scale computers – Architectures – Physical Infrastructure and Costs – Cloud Computing – Case Study – Google Warehouse – Scale Computer.					
UNIT V	VECTOR, SIMD AND GPU ARCHITECTURES	12			
Introduction – Vector Architecture – SIMD Extensions for Multimedia – Graphics Processing Units – Case Studies – GPU Computing – Detecting and Enhancing Loop Level Parallelism – Case Studies.					
Total Periods					60
Suggestive Assessment Methods					

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60 Marks)
1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ

Outcomes**Upon completion of the course, the students will be able to:**

C103.1	Identify the limitations of ILP.
C103.2	Discuss the issues related to multithreading and suggest solutions
C103.3	Design hierarchal memory system
C103.4	Discuss the various techniques used for optimizing the cache
C103.5	Point out the salient features of different multicore architecture
C103.6	Point out how data level parallelism is exploited in architectures. Performance and how they exploit parallelism.

Reference Books

1. Darryl Gove, "Multicore Application Programming: For Windows, Linux, and Oracle Solaris", Pearson, 2011
2. David B. Kirk, Wen - meiW. Hwu, "Programming Massively Parallel Processors", Morgan Kaufman, 2010
3. David E. Culler, Jaswinder Pal Singh, "Parallel computing architecture : A hardware/software approach", Morgan Kaufmann/ElsevierPublishers,1999
4. John L.Hennessey and David A. Patterson, "Computer Architecture - A Quantitative Approach", Morgan Kaufmann/Elsevier, 5th edition, 2012.
5. Kai Hwang and Zhi. WeiXu, "Scalable Parallel Computing", Tata Mc Graw Hill, New Delhi, 2003.

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C103.1	2	3		1											
C103.2		1	3	2											
C103.3	3	3	3									3			
C103.4	1	2	3	3	3										
C103.5	2	1	2	2	3	1						1			
C103.6	1	2	3	2	2							2			

21IF1603	MODERN OPERATING SYSTEM	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the basic knowledge on Operating Systems					
Objectives					
<ol style="list-style-type: none"> 1. Be able to understand the modern operating systems. 2. Learn how the processes are implemented in operating system. 3. Understand the implementation of the distributed operating systems. 4. To study database operating system and concurrency control algorithms. 5. Understand how program execution happens in mobile operating system. 					
UNIT I	PROCESS SYNCHRONIZATION	9			
Multiprocessor Operating Systems: System Architectures – Structures of OS – OS design issues – Process synchronization – Process Scheduling and Allocation – memory management.					
UNIT II	DISTRIBUTED OPERATING SYSTEMS	9			
Distributed Operating Systems: System Architectures – Design issues – Communication models – Clock synchronization – mutual exclusion – election algorithms – Distributed Deadlock detection					
UNIT III	DISTRIBUTED SCHEDULING	9			
Distributed scheduling – Distributed shared memory – Distributed File system – Multimedia file systems - File placement – Catching					
UNIT IV	DATABASE OPERATING SYSTEM	9			
Database Operating Systems: Requirements of Database OS – Transaction process model – Synchronization primitives – Concurrency control algorithms.					
UNIT V	MOBILE OPERATING SYSTEMS	9			
Mobile Operating Systems: ARM and Intel architectures – Power Management – Mobile OS Architectures – Underlying OS – Kernel structure and native level programming – Runtime issues - Approaches to power management					
Total Periods					45
Suggestive Assessment Methods					
Continuous Assessment Test(30Marks)	Formative Assessment Test(10Marks)	End Semester Exams(60 Marks)			
<ol style="list-style-type: none"> 1. Descriptive Questions 2. MCQ 	MCQ,SEMINAR,ASSIGNMENT	<ol style="list-style-type: none"> 1. Descriptive Questions 2. MCQ 			

Outcomes	
Upon completion of the course, the students will be able to:	
C104.1	To study the characteristics of OS for Multiprocessor and Multicomputer.
C104.2	To learn the issues related to designing OS.
C104.3	To identify the functionality of distributed Operating Systems.
C104.4	To explain the concepts of distributed scheduling.
C104.5	To analyze the issues related to database Operating System.
C104.6	To learn the latest trends in building Mobile OS.
Reference Books	
1. A S Tanenbaum, Distributed Operating Systems, Pearson Education Asia, 2001	
2. Source Wikipedia, Mobile Operating Systems, General Books LLC, 2010	
3. M Singhal and NG Shivaratri, Advanced Concepts in Operating Systems, Tata McGraw Hill nc, 2001.	

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C104.1	2					1						1			
C104.2		2	1	2											
C104.3	1	2		3		1						2			
C104.4	1		3		2	1						2			
C104.5		2	3	2		2									
C104.6			2	1	3		1								2

21IF1604	SOFTWARE ENGINEERING AND PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the basic knowledge on Software Engineering					
Objectives					
<ol style="list-style-type: none"> 1. To understand the process of Software Engineering 2. To conceptualize the Software Development Life Cycle (SDLC) models. 3. To familiarize Project Management framework and Tools 					
UNIT I	INTRODUCTION AND SOFTWARE PROCESS MODELS	9			
Introduction to Software Engineering: Software, Evolving role of software, Three “R” - Reuse, Reengineering and Retooling, An Overview of IT Project Management: Define project, project management framework, The role of project Manager, Systems View of Project Management, Stakeholder management, Project phases and the project life cycle. Waterfall Model, Evolutionary Process Model: Prototype and Spiral Model, Incremental Process model: Iterative approach, RAD, JAD model, Concurrent Development Model, Agile Development: Extreme programming, Scrum.					
UNIT II	SOFTWARE REQUIREMENT ANALYSIS AND SPECIFICATION	9			
Types of Requirement, Feasibility Study, Requirement Analysis and Design: DFD, Data Dictionary, HIPO Chart, Warnier Or Diagram, Requirement Elicitation: Interviews, Questionnaire, Brainstorming, Facilitated Application Specification Technique (FAST), Use Case Approach. SRS Case study, Software Estimation: Size Estimation: Function Point (Numericals). Cost Estimation: COCOMO (Numericals), COCOMO-II (Numericals). Earned Value Management.					
UNIT III	SOFTWARE PROJECT PLANNING AND SCHEDULING	9			
Business Case, Project selection and Approval, Project charter, Project Scope management: Scope definition and Project Scope management, Creating the Work Breakdown Structures, Scope Verification, Scope Control, Relationship between people and Effort: Staffing Level Estimation, Effect of schedule Change on Cost, Degree of Rigor & Task set selector, Project Schedule, Schedule Control, CPM (Numericals)					

UNIT IV	SOFTWARE QUALITY MANAGEMENT	9
Software and System Quality Management: Overview of ISO 9001, SEI Capability Maturity Model, Mc Calls Quality Model, Six Sigma, Formal Technical Reviews, Tools and Techniques for Quality Control, Pareto Analysis, Statistical Sampling, Quality Control Charts and the seven Run Rule. Modern Quality Management, Juran and the importance of Top management, Commitment to Quality, Crosby and Striving for Zero defects, Ishikawa and the Fish bone Diagram.		
UNIT V	HUMAN RESOURCE MANAGEMENT AND RISK MANAGEMENT	9
Human Resource Planning, Acquiring the Project Team: Resource Assignment, Loading, Leveling, Developing the Project Team: Team Structures, Managing the Project Team, Change management: Dealing with Conflict & Resistance Leadership & Ethics. Risk Management: Identify IT Project Risk, Risk Analysis and Assessment, Risk Strategies, Risk Monitoring and Control, Risk Response and Evaluation. Software Reliability: Reliability Metrics, Reliability Growth Modeling.		
Total Periods		45
Suggestive Assessment Methods		
Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60 Marks)
1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course, the students will be able to:		
C105.1	Apply use of knowledge of Software Life Cycle.	
C105.2	Identify the Inputs, Tools and techniques to get the required Project deliverables	
C105.3	To identify the scope of the project management and schedule control	
C105.4	Able to know the quality aspects of the real-time industry projects.	
C105.5	Able to manage the risks and builds the teamwork leadership.	

Reference Books

1. Software Engineering, 5th and 7th edition, by Roger S Pressman, McGraw Hill publication, 2019.
2. Managing Information Technology Project, 6th edition, by Kathy Schwalbe, Cengage Learning publication, 2018.
3. Information Technology Project Management by Jack T Marchewka Wiley India publication, 2015.
4. Software Engineering 3rd edition by KK Agrawal, Yogesh Singh, New Age International publication, 2017.
5. Software Engineering Project Management by Richard H. Thayer Wiley India Publication, 2015.
6. Software Engineering for students: A Programming Approach by Douglas Bell, Pearson publication, 2018.

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C105.1	2		1			3	1							2	
C105.2		1	2	1	3	2					3				
C105.3	2	3	3			1					2	1			
C105.4		2	3	2	2						2				1
C105.5		1	2	1	2				2		2				2

21IF1605	ADVANCED DATABASE TECHNOLOGY	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the basic knowledge on Database Management Systems.					
Objectives					
<ol style="list-style-type: none"> 1. To understand the design of databases. 2. To acquire knowledge on parallel and distributed databases and its applications. 3. To study the usage and applications of Object Oriented and Intelligent databases. 4. To understand the emerging databases like Mobile, XML, Cloud and Big Data. 					
UNIT I	PARALLEL AND DISTRIBUTED DATABASES	9			
Database System Architectures: Centralized and Client – Server Architectures – Server System Architectures – Parallel Systems – Distributed Systems – Parallel Databases: I/O Parallelism–Inter and Intra Query Parallelism – Inter and Intra operation Parallelism – Design of Parallel Systems Distributed Database Concepts – Distributed Data Storage – Distributed Transactions – Commit Protocols – Concurrency Control – Distributed Query Processing – Case Studies					
UNIT II	INTELLIGENT DATABASES	9			
Active Databases: Syntax and Semantics (Starburst, Oracle, DB2) – Taxonomy – Applications – Design Principles for Active Rules – Temporal Databases: Overview of Temporal Databases TSQL2 - Deductive Databases - Recursive Queries in SQL - Spatial Databases- Spatial Data Types – Spatial Relationships – Spatial Data Structures – Spatial Access Methods – Spatial DB Implementation.					
UNIT III	XML DATABASES	9			
XML Databases: XML Data Model – DTD – XML Schema – XML Querying – Web Databases – Open Database Connectivity.					
UNIT IV	MOBILE DATABASES	9			
Mobile Databases: Location and Handoff Management - Effect of Mobility on Data Management – Location Dependent Data Distribution – Mobile Transaction Models – Concurrency Control – Transaction Commit Protocols.					
UNIT V	MULTIMEDIA DATABASES	9			
Multidimensional Data Structures – Image Databases – Text / Document Databases – Video Databases – Audio Databases – Multimedia Database Design.					
Total Periods					45

Suggestive Assessment Methods		
Continuous Assessment Test(30Marks)	Formative Assessment Test(10Marks)	End Semester Exams(60 Marks)
1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course, the students will be able to:		
C106.1	To analyze parallel databases and its necessity and to develop skills on them.	
C106.2	To analyze distributed databases and its necessity and to develop skills on them.	
C106.3	To analyze intelligent databases and its necessity and to develop skills on databases to optimize their performance in practice.	
C106.4	Understand XML databases and its need.	
C106.5	Understand mobile databases and their effective role in mobility management.	
C106.6	Understand the use of Multimedia databases and to design faster Algorithms in solving practical database problem.	
Reference Books		
<ol style="list-style-type: none"> Henry F Korth, Abraham Silberschatz and S.Sudharshan, "Database System Concepts", Sixth Edition, Mc Graw Hill, 2011. C.J.Date, A.Kannan and S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. R.Elmasri, S.B.Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education / Addison Wesley, 2007. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007. Subramaniam, "Multimedia Databases", Morgan Kauffman Publishers, 2008. Vijay Kumar, "Mobile Database Systems" Wiley Interscience, A John Wiley & Sons, Inc., Publication, 2006. Carlo Zaniolo, Stefano Ceri, Christos Faloutsos, Richard T.Snodgrass, V.S.Subrahmanian, Roberto Zicari, "Advanced Database Systems " (The Morgan Kaufmann Series in Data Management Systems)1997. 		

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C106.1	1		2												1
C106.2	1		2			1						1			
C106.3	1	1	3			3									1
C106.4		1	2			2	1					1			2
C106.5	3	1	2	1		1						1			
C106.6	1	1	3			2									2

21IF1611	ADVANCED DATA STRUCTURES LABORATORY	L	T	P	C
		0	0	4	2
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the basic knowledge on Data structures. 					
Objectives					
<ol style="list-style-type: none"> To learn the implementation of sorting and searching. To acquire the knowledge of using advanced tree structures. To learn the usage of heap structures. To understand the usage of graph structures and spanning trees. 					
S.No	List of Experiments	CO			
1	Implementation of Merge Sort and Quick Sort - Analysis	C01			
2	Implementation of a Binary Search Tree	C01			
3	Red-Black Tree Implementation	C01			
4	Heap Implementation	C02			
5	Fibonacci Heap Implementation	C02			
6	Graph Traversals	C03			
7	Spanning Tree Implementation	C03			
8	Shortest Path Algorithms (Dijkstra's algorithm, Bell-mann Ford Algorithm)	C03			
9	Implementation of Matrix Chain Multiplication	C04			

10	Activity Selection and Huffman Coding Implementation.	CO4,C05	
S.No.	List of Projects	Related Experiment	CO
1.	OPTIMAL TREAPS	4	CO2
2.	KNIGHT'S TRAVAILS	6	CO3
3.	SEARCH ENGINE	3	CO1
4.	OBSURE BINARY SEARCH TREES	2	CO1
5.	TRAVELLING SALESMAN	6	CO3
6.	MUSIC PLAYER USING LINKED LIST	2	CO1
7.	ONLINE VOTING SYSTEM	1	CO1
8.	SUDOKU - BACKTRACKING	8	CO4
9.	TRAVEL PLAN - GRAPH	6	CO3
10.	SPIN AND WIN - ARRAYS AND MATH	1	CO1
11.	PHOTO EDITOR	9	CO5
12.	FILE ZIPPER - GREEDY HUFFMAN ENCODING	10	CO4,C05
13.	TEXT EDITOR - STACK	2	CO1
14.	SNAKES GAME - ARRAYS	4	CO3
15.	CASH FLOW MINIMIZER - HEAPS	4	CO2
Suggestive Assessment Methods			
Lab Components Assessments (50 Marks)		End Semester Exams (50 Marks)	
50		50	
Outcomes			
Upon completion of the course, the students will be able to:			
CO107.1	Design and implement basic and advanced data structures extensively.		

CO107.2	Develop and design programs for sorting and searching.
CO107.3	Design algorithms using graph structures
CO107.4	Design and develop efficient algorithms with minimum complexity using design techniques
CO107.5	Be able to design and analyze the time and space efficiency of the data structure.
Laboratory Requirements	
Stand-alone desktop with java development kit Compiler	
Reference Books	
<ol style="list-style-type: none"> 1. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint 2006. 2. Robert Sedgewick and Kevin Wayne, "ALGORITHMS", Fourth Edition, Pearson Education. 3. S.Sridhar, "Design and Analysis of Algorithms", First Edition, Oxford University Press. 2014 4. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011. 5. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice-Hall, 2011. 	
Web Resources	
<ol style="list-style-type: none"> 1. http://www.coursera.org/specialization/data-structures-algorithms 2. http://cse.iitm.ac.in/coursedetails 	

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1			2	1	3						3			2	
2		1	3		3						2			3	
3	1	2	3	3	3	1	1				3			3	
4			3	2	2						2				
5			2	1	3									1	1

COURSE CONTENT AND LECTURE SCHEDULE

S.NO	TOPIC	NO OF WEEKS REQUIRED
1	Implementation of Merge Sort and Quick Sort - Analysis	3
2	Implementation of a Binary Search Tree	4
3	Red-Black Tree Implementation	4
4	Heap Implementation	6
5	Fibonacci Heap Implementation	6
6	Graph Traversals	5
7	Spanning Tree Implementation	6
8	Shortest Path Algorithms (Dijkstra's algorithm, Bell-mann Ford Algorithm)	9
9	Implementation of Matrix Chain Multiplication	7
10	Activity Selection and Huffman Coding Implementation.	10

21IF1612	ADVANCED DATABASE TECHNOLOGY LABORATORY	L	T	P	C
		0	0	4	2
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the basic knowledge on Database Management Systems 					
Objectives					
5. To understand the concepts of DBMS. 6. To familiarize with SQL queries. 7. To write stored procedures in DBMS. 8. To learn front end tools to integrate with databases					
S.No	List of Experiments	CO			
1	Data Definition, Manipulation of Tables and Views, Database Querying – Simple queries	C0108.1			
2	Nested queries, Sub queries And Joins.	C0108.1			

3	Triggers, Transaction Control	C0108.1
4	Embedded SQL, Database Connectivity with Front End Tools High level language extensions	C0108.2
5	PL/SQL Basics, Procedures And Functions.	C0108.3
6	Active Databases	C0108.4
7	Deductive Databases.	C0108.4
8	Distributed and Parallel Transactions and Query Processing	C0108.4
9	Mobile Database Query Processing	C0408.3
10	Object Oriented Database Design	C0108.4
11	Multimedia Database for Image and Video Processing.	C0108.4
12	Spatial and Temporal Databases.	C0108.4
13	XML Databases and No SQL Database Storage and Retrieval	C0108.5

S.No.	List of Projects	Related Experiment	CO
16.	Inventory control management Database Project	1-13	C0108.1
17.	Student Record Keeping System Database Project	1-13	C0108.1
18.	Online Retail Application Database Project	1-13	C0108.1
19.	College Database Project	1-13	C0108.2
20.	Railway System Database Project	1-13	C0108.2
21.	Hospital Management System Database Project	1-13	C0108.2
22.	Wholesale Management System	1-13	C0108.3
23.	Hotel Management System Database Project	1-13	C0108.4
24.	Blood Donation System	1-13	C0108.4
25.	Restaurant Management System	1-13	C0108.4
26.	Token Booking Management System	1-13	C0408.3
27.	Electric Bill System Database	1-13	C0108.4
28.	Voice-Based Transport Enquiry System	1-13	C0108.4
29.	SMS – based Remote Server Monitoring System	1-13	C0108.4
30.	Bank Accounts Management System	1-13	C0108.5

Suggestive Assessment Methods	
Lab Components Assessments (50 Marks)	End Semester Exams (50 Marks)
50	50
Outcomes	
Upon completion of the course, the students will be able to:	
CO108.1	Formulate complex queries using SQL.
CO108.2	Design and Implement applications that have GUI and access databases for backend connectivity
CO108.3	Use PL / SQL procedures and functions
CO108.4	Implement the database concepts using query processing
CO108.5	Design and Implement databases and Use No SQL database storage and retrieval
Laboratory Requirements	
Standalone desktop, ORACLE, MS SQL Server	
Reference Books	
<ol style="list-style-type: none"> Henry F Korth, Abraham Silberschatz and S.Sudharshan, "Database System Concepts", Sixth Edition, Mc Graw Hill, 2011. C. J. Date, A. Kannan and S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006. R. Elmasri, S.B.Navathe, "Fundamentals of Database Systems", Fifth Edition, Pearson Education / Addison Wesley, 2007. Thomas Cannolly and Carolyn Begg, "Database Systems, A Practical Approach to Design, Implementation and Management", Third Edition, Pearson Education, 2007. 	
Web Recourses	
<ol style="list-style-type: none"> http://www.coursera.org/specialization/databasesystems http://www.gale.com/databases 	

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
1			2	1	3						3			2	
2		1	3		3						2			3	
3	1	2	3	3	3	1	1				3			3	
4			3	2	2						2				
5			2	1	3									1	1

S.NO	TOPIC	NO OF HOURS REQUIRED
1	Data Definition, Manipulation of Tables and Views, Database Querying – Simple queries	3
2	Nested queries, Sub queries And Joins.	3
3	Triggers, Transaction Control	3
4	Embedded SQL, Database Connectivity with Front End Tools High level language extensions	4
5	PL/SQL Basics, Procedures And Functions.	4
6	Active Databases	3
7	Deductive Databases.	3
8	Distributed and Parallel Transactions and Query Processing	4
9	Mobile Database Query Processing	3
10	Object Oriented Database Design	3
11	Multimedia Database for Image and Video Processing.	4
12	Spatial and Temporal Databases.	4
13	XML Databases and No SQL Database Storage and Retrieval	4

21IF2601	Machine Learning Techniques	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the basic knowledge on Artificial Intelligence					
Objectives					
<ol style="list-style-type: none"> To introduce students to the basic concepts and techniques of Machine Learning. To understand the concept behind artificial neural networks for learning non - linear functions. To become familiar with algorithms for learning Bayesian networks To learn, conceptualize and apply genetic algorithms To learn, understand and practice machine learning techniques focusing on modern industrial applications. 					
UNIT I	INTRODUCTION	9			
Designing a Learning system – Perspectives and issues in machine learning – Concept learning – General to specific ordering - Finding a maximally specific hypothesis - Candidate elimination algorithm – List – then - eliminate algorithm					
UNIT II	UNSUPERVISED LEARNING	9			
Clustering – Principle - Partition Based Clustering – K-means Clustering Algorithm – Numerical Example – K-medoid clustering Algorithm – Hierarchical Clustering – Agglomerative Clustering And Divisive Clustering – Application of k-means clustering on Crime dataset.					
UNIT III	SUPERVISED LEARNING	9			
Bayesian Learning: Bayes Theorem and concept learning – Maximum likelihood and Least squared error hypothesis – Naïve Bayes classifier – Bayesian Belief Networks – Conditional independence – Representation – Inference – Learning Bayesian Belief Networks – Application of Naïve Bayes classifier on Iris dataset.					
UNIT IV	DECISION TREE LEARNING	9			
Introduction – Decision Tree Representation – Appropriate problems for decision tree learning –Attribute selection – Basic decision tree learning algorithm – Issues in decision tree learning – over fitting – missing attributes – Application of decision tree on health care dataset.					
UNIT V	ENGINEERING APPLICATIONS AND CASE STUDIES	9			
Introduction to ML applications in Engineering – Civil Engineering : Natural disaster prediction, Transport data analysis - Mechanical Engineering: IoT and on-site performance analysis, Electrical Engineering : Load balancing, power distribution, control and feedback systems – Electronics Engineering: Pattern recognition – Information Technology: Data science, Recommendation systems.					
Total Periods					45

Suggestive Assessment Methods		
Continuous Assessment Test(30Marks)	Formative Assessment Test(10Marks)	End Semester Exams(60 Marks)
1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course ,the students will be able to :		
C201.1	Gain knowledge about basic concepts of Machine Learning	
C201.2	Understand unsupervised learning techniques	
C201.3	Understand supervised learning techniques	
C201.4	Understand Tree based learning and its applications	
C201.5	Solve the problems using various machine learning techniques in the field of mechanical and civil engineering	
C201.6	Solve the problems using various machine learning techniques in the Field of electrical and electronics engineering.	
Reference Books		
1. Mitchell Tomm, Machine Learning. Tata Mc Graw Hill Education Pvt Limited, Revised Indian Re print, 2013. 2. Mohsenn Mohammed, Muhammad Badrudding Khan, Mohammed Basheir E.B, Machine Learning algorithms and applications, Taylor& Francis, 2016 3. Christopher M. Bishop. Pattern Recognition and Machine Learning, Springer 2007. 4. S.Haykin. Neural networks and learning machines. Pearson 2008. 5. T.Hastie, R.Tibshirani and J.Friedman. The Elements of Statistical Learning. Springer 2011.		

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
C201.1		2	3	3	2							2			
C201.2	1	2	3	3	2									1	
C201.3	3	3	3									3			
C201.4	1	2	3	3	3										
C201.5	1	2	1	1								1			
C201.6	1	2		1								2			

21IF2602	ADVANCED NETWORK SECURITY	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the fundamental knowledge on Computer Networks.					
Objectives					
<ol style="list-style-type: none"> 1. To learn security mechanisms and techniques to provide security services. 2. To be exposed to symmetric & asymmetric key algorithms and key management aspects. 3. To learn the algorithms using encryption and authentication. 4. To learn about the Network Security Applications. 					
UNIT I	SYMMETRIC & ASYMMETRIC KEY ALGORITHMS	9			
Substitutional Ciphers, Transposition Ciphers, Data Encryption Standard (DES) – Triple DES, Block Cipher modes of operation - AES Cipher.					
UNIT II	PUBLIC KEY CRYPTOGRAPHY	9			
Introduction to number Theory: Modular Arithmetic - Euclid's Algorithm - Fermat's and Euler's Theorems - The Chinese Remainder Theorem and Discrete Logarithms. Public Key Cryptography and RSA – Key Management – Diffie – Hellman key Exchange.					
UNIT III	AUTHENTICATION	9			
Hash Algorithms: MD5 Message Digest Algorithm – Secure Hash Algorithm – RIPEMD-160 – HMAC. Digital Signatures – Digital Signature Standard – User Authentication Protocols.					
UNIT IV	NETWORK SECURITY APPLICATIONS	9			
Kerberos - Web Security: Web Security issues- Secure Sockets Layer (SSL) and Transport Layer Security (TLS) – Secure Electronic Transaction (SET). Electronic Mail Security: PGP - S/MIME.					
UNIT V	SYSTEM LEVEL SECURITY	9			
Intrusion detection – password management – Viruses and related Threats – Virus Counter Measures - Firewall Design Principles – Trusted Systems.					
Total Periods					45
Suggestive Assessment Methods					
Continuous Assessment Test(30Marks)		Formative Assessment Test(10Marks)		End Semester Exams(60 Marks)	
<ol style="list-style-type: none"> 1. Descriptive Questions 2. MCQ 		MCQ,SEMINAR,ASSIGNMENT		<ol style="list-style-type: none"> 1. Descriptive Questions 2. MCQ 	
Outcomes					
Upon completion of the course, the students will be able to :					

C202.1	Apply the mathematical foundations in security principles.
C202.2	Identify the features of encryption and decryption.
C202.3	Apply various Encryption, Authentication and Digital Signature Algorithms.
C202.4	Deal with different general purpose and application specific Security Protocols and Techniques.
C202.5	Understand the Network Security Applications.

Reference Books

1. William Stallings, "Cryptography and Network Security – Principles and Practices", 5th Edition, Pearson Education, 2010.
2. Behrouz A. For uzan and Debdeep Mukhopadhyay, "Cryptography and Network Security", 2nd Edition, Tata Mc Graw - Hill, 2010.
3. Bruce Schneier, "Applied Cryptography: Protocols, Algorithms and Source Code in C", 2nd Edition, Wiley India (P) Ltd., 2008.
4. Charles P. P fleeger and Shari Lawrence P fleeger, "Security in Computing", 4th edition, Pearson Education, 2011.

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C202.1	3		2	2									
C202.2	3	3	3	2				3	3	3			
C202.3			3	3	3			3	3				
C202.4	1			2				2	2				
C202.5	2		3	3	3			3	2	3			
C202.6		2		2	3	3	2			3			

21IF2603	INTERNET OF THINGS	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the knowledge on Microprocessors					
Objectives					
<ol style="list-style-type: none"> To explore various components of Internet of things such as Sensors, internetworking and cyberspace. To understand the various IoT protocols used for communication To design and develop the program for IoT devices To Design an IoT devices to work with a Cloud Computing infrastructure. Able to design and implement IoT circuits and solutions. 					
UNIT I	INTRODUCTION TO INTERNET OF THINGS	9			
Introduction To IoT: Sensing, Actuation, Networking basics, Communication Protocols, Sensor Networks, Machine-To -Machine Communications, IoT Definition, Characteristics. IoT Functional Blocks, Physical design of IoT, Logical design of IoT, Communication models & APIs.					
UNIT II	IOT STRUCTURE	9			
M2M to IoT - The Vision - Introduction, From M2M to IoT, M2M towards IoT - the global context, A Usecase example, Differing Characteristics. Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT					
UNIT III	IOT ARCHITECTURE	9			
IoT Reference Architecture – Getting Familiar with IoT Architecture, Various architectural views of IoT such as Functional, Information, Operational and Deployment. Constraints affecting design in IoT world - Introduction, Technical design Constraints					
UNIT IV	APPLICATIONS OF IOT	9			
Home automation, Industry applications, Surveillance applications, Other IoT applications					
UNIT V	DEVELOPING IOT SOLUTIONS	9			
Introduction to Python ,Introduction to different IoT tools, Introduction to Arduino and Raspberry Pi Implementation of IoT with Arduino and Raspberry, Cloud Computing, Fog Computing, Connected Vehicles, Data Aggregation for the IoT in Smart Cities, Privacy and Security Issues in IoT.					
Total Periods					45
Suggestive Assessment Methods					
Continuous Assessment Test(30Marks)		Formative Assessment Test(10Marks)		End Semester Exams(60 Marks)	

1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course ,the students will be able to :		
C203.1	Understand general concepts of Internet of Things (IoT) (Understand)	
C203.2	Recognize various devices, sensors and applications (Knowledge)	
C203.3	Analyze various M2M and IoT Architectures (Analyze)	
C203.4	Apply design concept to IoT Solutions (Apply)	
C203.5	Evaluate design issues in IoT Applications (Evaluate)	
C203.6	Create IoT solutions using sensors, actuators and Devices (Create)	
Reference Books		
<ol style="list-style-type: none"> Vijay Madiseti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition ,VPT,2014 Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Stamatis Karnouskos, David Boyle, "From Machine-To -Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014. Francis da Costa, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, A press Publications, 2013 Cuno P fister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1-4493- 9357-1. Srinivasa KG, "Internet of Things", CENGAGE Learning India, 2017. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, Mc Graw Hill Education, 2017. 		

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
C203.1	3					3				3			
C203.2	2		3	3		2				3			
C203.3			3	3						3			
C203.4		3	3	3	3								
C203.5		3	2	3	3								
C203.6		3	3	3	2								

21IF2604	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3
Prerequisites for the course					
The students should have the knowledge on database and cloud concepts					
Objectives					
<ol style="list-style-type: none"> 1. To understand the competitive advantages of big data analytics 2. To understand the big data frame works 3. To learn data analysis methods 4. To learn stream computing 5. To gain knowledge on Hadoop related Tools such as H-Base, Cassandra, Pig, and Hive for big data analytics. 					
UNIT I	INTRODUCTION TO BIG DATA	9			
Big Data – Definition , Characteristic Features – Big Data Applications - Big Data vs Traditional Data - Risks of Big Data - Structure of Big Data - Challenges of Conventional Systems - Web Data – Evolution of Analytic Scalability - Evolution of Analytic Processes, Tools and methods - Analysis Vs Reporting – Modern Data Analytic Tools.					
UNIT II	HADOOP FRAMEWORK	9			
Distributed File Systems – Large – Scale File System Organization – HDFS concepts – Map Reduce Execution, Algorithms using Map Reduce, Matrix-Vector Multiplication – Hadoop YARN.					
UNIT III	DATA ANALYSIS	9			
Statistical Methods: Regression modeling, Multivariate Analysis - Classification : SVM & Kernel Methods - Rule Mining - Cluster Analysis, Types of Data in Cluster Analysis, Partitioning Methods, Hierarchical Methods, Density Based Methods, Grid Based Methods, Model Based Clustering Methods, Clustering High Dimensional Data – Predictive Analytics – Data analysis using R.					
UNIT IV	MINING DATA STREAMS	9			
Streams: Concepts – Stream Data Model and Architecture – Sampling data in a stream - Mining Data Streams and Mining Time – series data – Real Time Analytics Platform (RTAP) Applications – Case Studies-Real Time Sentiment Analysis, Stock Market Predictions.					
UNIT V	BIG DATA FRAMEWORKS	9			
Introduction to No-SQL – Aggregate Data Models – H-base: Data Model and Implementations –H-base Clients – Examples – .Cassandra: Data Model – Examples – Cassandra Clients – Hadoop Integration. Pig – Grunt – Pig Data Model – Pig Latin – developing and testing Pig Latin scripts. Hive – Data-types and File Formats – Hive-QL Data Definition – Hive- QL Data Manipulation – Hive-QL Queries.					
Total Periods					45

Suggestive Assessment Methods		
Continuous Assessment Test(30Marks)	Formative Assessment Test(10Marks)	End Semester Exams(60 Marks)
1. Descriptive Questions 2. MCQ	MCQ,SEMINAR,ASSIGNMENT	1. Descriptive Questions 2. MCQ
Outcomes		
Upon completion of the course ,the students will be able to :		
C204.1	Understand how To leverage the insights from big data analytics	
C204.2	Understand the concepts on Hadoop framework	
C204.3	Analyze data by utilizing various statistical approaches	
C204.4	Analyze data by utilizing various data mining approaches	
C204.5	Perform analytics on real-time streaming data	
C204.6	Understand the various No-SQL alternative database models	
Reference Books		
<ol style="list-style-type: none"> 1. Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams With Advanced Analytics", Wiley and SAS Business Series, 2012. 2. David Loshin,"Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No-SQL, and Graph", 2013. 3. Learning R–A Step-by-step Function Guide to Data Analysis, Richard Cotton, O'Reilly Media, 2013. 4. Michael Berthold, David J. Hand, "Intelligent Data Analysis", Springer, Second Edition , 2007. 5. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013. 6. P.J.Sadalage and M.Fowler, "No-SQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison –Wesley Professional, 2012. 		

COVs PO Mapping and CO Vs PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO204.1	3	3								3			
CO204.2	3	3											
CO204.3	3	3	3	2	3				2	2			
CO204.4	3	3	3	2	3				2	2			
CO204.5	3	3	3	3	3	2			2	2			
CO204.6	3	3								3			

21IF2911	TECHNICAL PAPER WRITING AND SEMINAR	L	T	P	C
		0	0	2	1
Objectives					
<ul style="list-style-type: none"> • In this course, students will develop the scientific and technical reading and writing skills they need. • To understand and construct research articles. A term paper requires a student to obtain information from a variety of sources (i.e., Journals, dictionaries, reference books) and then place it in logically developed ideas. The work involves the following steps: Selecting a subject narrowing the subject into a Topic <ol style="list-style-type: none"> 1. Stating an objective. 2. Collecting the relevant bibliography(atleast15journalpapers) 3. Preparing a working outline. 4. Studying the papers and understanding the authors contributions and critically analyzing each paper. 5. Preparing a working outline 6. Linking the papers and preparing a draft of the paper. 7. Preparing conclusions based on the reading of all the papers. 8. Writing the Final Paper and giving final Presentation Please keep a file where the work carried out by you is maintained. Activities to be carried out. 					

Activity	Instructions	Submission week	Evaluation
Selection of area of interest and Topic	You are requested To select an area of interest, Topic and state an objective	2 nd week	3 % Based on clarity of thought, current relevance and clarity in writing
Stating an Objective			
Collecting Information about your area & Topic	<ol style="list-style-type: none"> 1. List 1 Special Interest Groups or professional society 2. List 2 journals 3. List 2 conferences, symposia or workshops 4. List 1thesis title List3web presences (mailing lists, forums, news sites) 5.List 3 authors who publish regularly in your area 6. Attach a call for papers (CFP) from your area. 	3 rd week	3% (the selected information must be area specific and of international and national standard)
Collection of Journal papers in the Topic in the con text of the objective – collect 20 &then filter	<ul style="list-style-type: none"> • You have To provide a complete list of references you will be using- Based on your objective -Search various digital libraries and Google Scholar • When picking papers to read-try To : <ul style="list-style-type: none"> • Pick papers that are related To each other in some ways and/or that are in the same field so that you can write a meaningful survey out of them, • Favour papers from well-known journals and conferences, • Favour “first” or “foundation al” papers in the field (as indicated in other people’s survey paper), • Favour more recent papers, • Pick a recent survey of the field so you can quickly gain an overview, • Find relationships with respect To each other and To your Topic area(classification scheme/categorization) • Mark in the hard copy of papers whether complete work or section /sections of the paper are being considered 	4 th week	6% (the list of standard papers and reason for selection)
Reading and notes for first5papers	<p>Reading Paper Process</p> <ul style="list-style-type: none"> • For each paper formatable answering the following questions: <ul style="list-style-type: none"> • What is the main topic of the article? • What was/were the main issue(s) the author said they want to discuss? • Why did the author claim it was important? • How does the work build on other’s work, in the author’s opinion? 	5 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your Conclusions about each paper)

	<ul style="list-style-type: none"> • What simplifying assumptions does the author claim To be making? • What did the author do? • How did the author claim they were going to evaluate their work and compare it to others? • What did the author say were the limitations of their research? • What did the author say were the important directions for future research? <p>Conclude with limitations/issues not addressed by the paper (from the perspective of your survey)</p>		
Reading and notes for next5papers	Repeat Reading Paper Process	6 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on your conclusions About each paper)
Reading and notes for final5papers	Repeat Reading Paper Process	7 th week	8% (the table given should indicate your understanding of the paper and the evaluation is based on Your conclusions about each paper)
Draft outline 1and Linking papers	Prepare a draft Outline, your survey goals, along with a classification / categorization diagram	8 th week	8% (this component will be evaluated based on the linking and classification among the papers)
Abstract	Prepare a draft abstract and give a presentation	9 th week	6% (Clarity, purpose and conclusion) 6% Presentation & Viva Voce

Introduction Background	Write an introduction and background sections	10 th week	5% (clarity)
Sections of the paper	Write the sections of your paper based on the classification / categorization diagram in keeping with the goals of your survey	11 th week	10% (this component will be evaluated based on the linking and classification among the papers)
Your Conclusions	Write your conclusions and future work	12 th week	5% (conclusion s -clarity and your ideas)
Final Draft	Complete the final draft of your paper	13 th week	10% (formatting, English, Clarity and linking) 4% Plagiarism Check Report
Seminar	Abrief15slides on your paper	14 th & 15 th week	10% (based on presentation and Viva-voce)

Total Periods:30**Suggestive Assessment Methods****Lab Components Assessments(50Marks)**

- Presentations, Reviews

End Semester Exams(50Marks)

- Presentations, Reviews

Outcomes:**Upon completion of the course ,the students will be able to :**

- C207.1 Choose the field and topic of their dissertation
- C207.2 Inculcating academic skills, including preparing and conducting research
- C207.3 Implement project activities
- C207.4 Writing and publishing papers and articles

C207.5 Gather, systematize, and process information and prepare analytic reports and documents.

C207.6 Acquainting the standard work flow in government bodies and public organizations

COVs PO Mapping and CO Vs PSO Mapping

CO	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010	PS01	PS02	PS03
C207.1	1						2	3					
C207.2	2					1			3				
C207.3	1							2	3				
C207.4			2						3	1			
C207.5	2					1			3				
C207.6	1							2	3				

21IF2611	DATA ANALYTICS LABORATORY	L	T	P	C
		0	0	4	2
Prerequisites for the course					
The students should have the knowledge on Java programming.					
Objectives					
<ul style="list-style-type: none"> • To learn and implement basic concepts in Hadoop • To learn and implement clustering techniques 					
S.No	List of Experiments	CO			
1	Install, configure and run Hadoop and HDFS	C01			
2	Implement word count/ frequency programs using Map Reduce	C02			
3	Implement an MR program that processes a weather dataset	C02			
4	Implement Linear and logistic Regression	C03			
5	Implement SVM/Decision tree classification techniques	C03			
6	Implement clustering techniques	C04			
7	Visualize data using any plotting framework	C05			
8	Implement an application that stores big data in H-base/Mongo DB/ Pig using Hadoop /R.	C06			
Total Periods: 60					
Suggestive Assessment Methods					

Lab Components Assessments (50Marks)	End Semester Exams (50Marks)
<ul style="list-style-type: none"> Experiments, Viva 	<ul style="list-style-type: none"> Experiments, Viva
Outcomes:	
<p>Upon completion of the course ,the students will be able to :</p> <p>C208.1 Process big data using Hadoop framework.</p> <p>C208.2 Build and apply linear regression models.</p> <p>C208.3 Build and apply logistic regression models.</p> <p>C208.4 Perform data analysis with machine learning methods.</p> <p>C208.5 Perform graphical data analysis.</p> <p>C208.6 Implement applications using that backups the data in H-base/Mongo DB/ Pig</p>	
Laboratory Requirements	
Standalone desktop, Hadoop, Cloud end database.	
Reference Books	
<ol style="list-style-type: none"> Bill Franks, "Taming the Big Data Tidal Wave: Finding Opportunities in Huge Data Streams with Advanced Analytics", Wiley and SAS Business Series, 2012. David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, No-SQL, and Graph", 2013. Learning R–A Step-by-step Function Guide To Data Analysis, Richard Cotton, O'Reilly Media, 2013. 	
Web Resources	
www.cloudresources.net	

CO Vs PO Mapping and CO vs. PSO Mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO208.1	3	3								3			
CO208.2	3	3											
CO208.3	3	3	3	2	3				2	2			
CO208.4	3	3	3	2	3				2	2			
CO208.5	3	3	3	3	3	2			2	2			
CO208.6	3	3								3			

PROFESSIONAL ELECTIVE-I

21F2701	DATA AND CLOUD SECURITY	L	T	P	C
		3	0	0	3
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the knowledge on cloud computing. 					
Objectives					
<ol style="list-style-type: none"> To learn the importance of security in cloud computing To learn the concepts of asset management in cloud To study the security issues in cloud 					
UNIT I	INTRODUCTION TO CLOUD COMPUTING ARCHITECTURE AND SECURITY	9			
Understanding Cloud Computing –The IT foundation for Cloud – A Brief Primer on Security – Security Architecture – Cloud Reference Architecture - Control over Security in the Cloud Model – Making sense of Cloud Deployment–Real-world Cloud Usage Scenarios.					
UNIT II	DATA AND CLOUD ASSET MANAGEMENT	9			
Threat Actors, Diagrams, and Trust Boundaries-Cloud Delivery Models-The Cloud Shared Responsibility Model -Risk Management; Data Asset Management and Protection : Data Identification and Classification - Data Asset Management in the Cloud - Protecting Data in the Cloud; Cloud Asset Management and Protection : Differences from Traditional IT–Types of Cloud Assets–Asset Management Pipeline.					
UNIT III	VULNERABILITY AND IDENTITY ACCESS MANAGEMENT	9			
Identity and Access Management: Differences from Traditional IT - Life Cycle for Identity and Access Authentication –Authentication –Authorization –Revalidate; Vulnerability Access Management : Vulnerable Areas – Finding and Fixing Vulnerabilities – Cloud Provider Security Management Tools–Risk Management Processes – Vulnerability Management Metrics – Change Management					
UNIT IV	NETWORK SECURITY	9			
Concepts and Definitions–Encryption in Motion –Firewalls and Network Segmentation – Allowing Administrative Access – Web Application Firewalls and RASP – Anti-DDoS – Intrusion Detection and Prevention Systems –Egress Filtering–Data Loss Prevention					
UNIT V	SECURITY AND EVALUATION CRITERIA	9			
Building an Internal Cloud -Private Clouds: Motivation and Overview - Security Criteria for Ensuring a Private Cloud –Selecting an External Cloud Provider - Evaluating Cloud Security: An					

Information Security Framework – Checklists for Evaluating Cloud Security		
Total Periods		45
Suggestive Assessment Methods		
Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
<ul style="list-style-type: none"> • Descriptive questions • MCQ 	<ul style="list-style-type: none"> • MCQ • Assignment • Seminar 	<ul style="list-style-type: none"> • Descriptive questions • MCQ
Outcomes		
Upon completion of the course ,the students will be able to :		
C205-1.1	Understand the importance of security in cloud computing	
C205-1.2	Understand the concepts of asset management in cloud	
C205-1.3	Understand the security issues in cloud	
C205-1.4	Identify the vulnerabilities and how To handle them.	
C205-1.5	Apply various mechanisms to handle security issues in cloud	
C205-1.6	Build an internal cloud	
Text Books		
<ol style="list-style-type: none"> 1. J.R.("Vic")Winkler, “Securing the Cloud: Cloud Computer Security Techniques and Tactics”, Syngress, 2011. 2. Greg Schulz, “Cloud and Virtual Data Storage Networking”, CRCPress, 2012. 		
Reference Books		
<ol style="list-style-type: none"> 1. Ronald L. Kurtz, Russell Dean Vines, “Cloud Security–A Comprehensive Guide to Secure CloudComputing”, WileyPublishiing, 2010. 2. TimMather,SubraKumaraswamy,ShahedLatif,“CloudSecurityandPrivacy:An Enterprise Perspective on Risks and Compliance”, O’Reilly Media, First edition, 2009. 3. Lee New combe, “Securing Cloud Services”, IT Governance Publishing, 2012. 		
Web Resources		
1. https://blog.netwrix.com/2020/07/02/cloud-data-security/		

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
C205-1.1	3	3								3				3	
C205-1.2	3	3								3			3	3	

CO205-1.3	3	3						3	3	3				3	
CO205-1.4	3	3						3	3	3			2	3	
CO205-1.5	3	3	3	2	3	2			3	3				3	
CO205-1.6	3	3	3	2	3	2			3	3				3	

21F2702	NETWORK AND WIRELESS SECURITY	L	T	P	C
		3	0	0	3

Prerequisites for the course

- The students should have the basic idea on wired and wireless networks.

Objectives

- To learn about securing wireless networks
- Identify and analyze various the security issues in wireless mobile communication.
- To learn various issues of application level security in wireless environment and its related solution.
- To understand the fundamental protocols involved in wireless network security.
- To understand the fundamental concepts involved in wireless threats.

UNIT I	SECURITY ISSUES IN MOBILE COMMUNICATION	9
Mobile Communication History - Security Wired Vs. Wireless - Security Issues in Wireless and Mobile Communications - Mobile Devices Security Requirements, Mobile Wireless network level Security, Server Level Security. Application Level Security in Wireless Networks - Application of WLANs, Wireless Threats, Security for 2G Wi-Fi Applications, Recent Security Schemes for Wi-Fi Applications		
UNIT II	APPLICATION LEVEL SECURITY IN CELLULAR NETWORKS AND MANETS	9
Generations of Cellular Networks, Security Issues and attacks in cellular networks, GSM, GPRS and UMTS security for applications, 3G security for applications - MANETs, applications of MANETs, MANET Features, Security Challenges in MANETs, Security Attacks on MANETs		
UNIT III	APPLICATION LEVEL SECURITY IN UBIQUITOUS NETWORKS AND HETEROGENEOUS WIRELESS NETWORKS	9
Ubiquitous Computing, Need for Novel Security Schemes for UC, Security Challenges for UC, Heterogeneous Wireless network architecture, Heterogeneous network application in disaster management, Security problems and solutions in heterogeneous wireless networks.		
UNIT IV	WIRELESS SENSOR NETWORK SECURITY	9

Attacks on wireless sensor networks and counter measures Prevention mechanisms: authentication and traffic protection centralized and passive intruder detection decentralized intrusion detection

UNITV	WIRELESS THREATS	9
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Introduction to wireless technologies - history, challenges, risks, advances in wireless security, Radio Frequency – RF Terminology, interference, covert channels, and hardware. Hacking 802.11 wireless technologies- eavesdropping, jamming - wireless channel vulnerability analysis, WiFi cybercrimes and awareness-countermeasures-wireless security standards wireless Setup, risks and security controls.

Total Periods	45
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Suggestive Assessment Methods

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
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- | | | |
|---|--|--|
| <ul style="list-style-type: none"> • Descriptive question s • MCQ | <ul style="list-style-type: none"> • MCQ • Assignment • Seminar | <ul style="list-style-type: none"> • Descriptive questions • MCQ |
|---|--|--|

Outcomes

Upon completion of the course, the students will be able to :

- | | |
|----------|---|
| C205-2.1 | Identify the requirement of security and various issues at wireless and mobile network. |
| C205-2.2 | Analyze the threats in wireless environment including device, networks and servers. |
| C205-2.3 | Distinguish the attacks at various protocols in wireless network and differentiate the solution required for the m. |
| C205-2.4 | Assess the security requirement for mobile adhoc environment, ubiquitous environment |
| C205-2.5 | Implement the security solution for various environment in wireless network |
| C205-2.6 | Analyze security threats related to wireless network |

Textbooks

1. Pallapa Venkataram, Satish Babu, Wireless and Mobile Network Security, First Edition, Tata Mc Graw Hill, 2010.
2. Tara M. Swami Nathan and Charles R. Eldon, Wireless Security and Privacy-Best Practices and Design Techniques, Addison Wesley, 2002.

Reference Books

1. Behrouz Forouzan, "Cryptography & Network Security", Tata Mc Graw Hill, 2008. Wolfgang Osterhage, "Wireless Security", CRC Press, 2011.

Web Resources

1. <http://www.securew2.com/>

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03

CO205-2.1	1		2			3								
CO205-2.2		1		2				2						
CO205-2.3	1		2					3						
CO205-2.4	1		2				3							
CO205-2.5			1			2		3						3
CO205-2.6		2			2			3						

21IF2703	ENERGY AWARE COMPUTING	L	T	P	C
		3	0	0	3
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the knowledge on computer architecture. 					
Objectives					
<ol style="list-style-type: none"> To understand the fundamentals of Energy Efficient Computing To understand the concept of Energy Efficient Storage Systems To introduce the various types of scheduling algorithms in energy efficient computing To introduce the concept of Green Networking To study Energy Aware Computing Applications 					
UNIT I	INTRODUCTION	9			
Sub-res-hold Computing – Energy Efficient Network-on -Chip Architectures for Multi-Core Systems-Energy-EfficientMIPSCPUCorewithFine-GrainedRun-TimePowerGating- CaseStudy:Geysers					
UNIT II	ENERGY EFFICIENT STORAGE	9			
Power-Efficient Strategies for Storage Systems -Energy-Saving Techniques for Disk Storage Systems -Thermal and Power-Aware Task Scheduling and Data Placement for Storage Centric Datacenters - Energy -Saving Techniques for Disk Storage Systems					
UNIT III	ENERGY EFFICIENT SCHEDULING ALGORITHMS	9			
Algorithms and Analysis of Energy-Efficient Scheduling of Parallel Tasks-Dynamic Voltage Scaling-Speed Scaling-Memetic Algorithms for Energy-Aware Computation and Communication optimization in Computing Clusters-Online job scheduling Algorithms					
UNIT IV	INTRODUCTION TO GREEN NETWORKING	9			

Power-Aware Middleware for Mobile Applications-Energy Efficiency of Voice-over-IP Systems-
Intelligent Energy - Aware Networks-Green TCAM-Based Internet Routers

UNIT V	ENERGY AWARE COMPUTING APPLICATIONS	9
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Energy Awareness in Video Codec Design – Overview of H.264 / AVC Video Codec Design - Energy
Aware Surveillance Camera -Low Power Design Challenge in Biomedical Implant Electronics

Total Periods	45
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Suggestive Assessment Methods

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
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- | | | |
|--|--|--|
| <ul style="list-style-type: none"> • Descriptive questions • MCQ | <ul style="list-style-type: none"> • MCQ • Assignment • Seminar | <ul style="list-style-type: none"> • Descriptive questions • MCQ |
|--|--|--|

Outcomes

Upon completion of the course ,the students will be able to :

- C205-3.1 Design Power efficient architecture Hardware and Software
- C205-3.2 Analyze the different types of Energy Efficient Storage systems.
- C205-3.3 Identify the different types of Green Networking schemes in the energy efficient computing
- C205-3.4 Explore the application s of Energy Aware Computing
- C205-3.5 Gain familiarity with state-of-the -art Tools such as processor simulators, memory models and use them To implement and evaluate techniques described in the technical literature
- C205-3.6 Locate, summaries and discuss critically peer-reviewed literature on specific sub area of energy-aware computing

Textbooks

1. BobSteigerWald,Chris:Luero,EnergyAwarecomputing,IntelPress,2012
2. Chon g-MinKyung,Sungiooyoo,EnergyAwaresystemdesignAlgorithmsandArchitecture, Springer,2011

Reference Books

1. IshfaqAhmad, SanjayRanka, HandbookOfEnergyAwareandGreenComputingChapmaand Hall/ CRC, 2012.

CO Vs PO Mapping and CO Vs PSO Mapping

CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS	
	1	2	3	4	5	6	7	8	9	10	11	12	01	02	03	
C205-3.1	1				2					3						
C205-3.2			2	2	2											

C205-3.3	1					3		3						
C205-3.4			1		2				3					
C205-3.5		1		2				3			3			
C205-3.6	1		2		1			3			3			

21F2704	BIO-INSPIRED COMPUTING AND IMAGE PROCESSING APPLICATIONS	L	T	P	C
		3	0	0	3
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the knowledge on Artificial Intelligence. 					
Objectives					
<ol style="list-style-type: none"> To Learn bio-inspired theorem and algorithms To Understand random walk and simulated annealing To Learn genetic algorithm and differential evolution To Learns warm optimization and ant-colony for feature selection To understand bio-inspired application in image processing 					
UNIT I	INTRODUCTION	9			
Introduction To algorithm-Newton's method-optimization algorithm -No-Free-Lunch Theorems - Nature-InspiredMataheuristics-AnalysisofAlgorithms-NatureInspires Algorithms-Parameter tuning and parameter control.					
UNIT II	RANDOM WALK AND ANEALING	9			
Random variables - Isotropic random walks - Levy distribution and flights - Markov chains – step sizes and search efficiency-Modality and intermittent search strategy-importance of randomization -Eagle strategy-Annealing and Boltzmann Distribution - parameters - SA algorithm - Stochastic Tunneling.					
UNITIII	GENETICALGORITHMSSANDDIFFERENTIAL EVOLUTION	9			
Introduction To genetic algorithms and - role of genetic operators - choice of parameters - GA variants-schema theorem-convergence analysis-introduction To differential evolution -variants -choice of parameters -convergence analysis -implementation .					
UNITIV	SWARM OPTIMIZATION AND FIREFLY ALGORITHM	9			
Swarm Intelligence - PSO algorithm - accelerated PSO - implementation - convergence analysis - binary PSO - The Firefly algorithm - algorithm analysis - implementation - variants- Ant colony optimization Toward feature selection.					

UNITV	APPLICATION IN IMAGE PROCESSING											9				
Bio-Inspired Computation and its Applications in Image Processing: An Overview - Fine-Tuning Enhanced Probabilistic Neural Networks Using Meta-heuristic-driven Optimization - Fine-Tuning Deep Belief Networks using Cuckoo Search - Improved Weighted Threshold Histogram Equalization Algorithm for Digital Image Contrast Enhancement Using Bat Algorithm - Ground Glass Opacity Nodules Detection and Segmentation using Snake Model-Mobile Object Tracking Using Cuckoo Search														Total Periods		45
Suggestive Assessment Methods																
Continuous Assessment Test (30Marks)				Formative Assessment Test (10Marks)					End Semester Exams (60Marks)							
<ul style="list-style-type: none"> • Descriptive questions • MCQ 				<ul style="list-style-type: none"> • MCQ • Assignment • Seminar 					<ul style="list-style-type: none"> • Descriptive questions • MCQ 							
Outcomes																
Upon completion of the course ,the students will be able to :																
C205-4.1		Implement and apply bio-inspired algorithms														
C205-4.2		Explain random walk and simulated annealing														
C205-4.3		Implement and apply genetic algorithms														
C205-4.4		Explain swarm Intelligence and ant colony for feature selection														
C205-4.5		Apply bio-inspired techniques in image processing.														
C205-4.6		Insight in biologically inspired as well as traditional machine learning methods for search, optimization and classification.														
Textbooks																
<ol style="list-style-type: none"> 1. Eiben, A.E., Smith, James E, "Introduction to Evolutionary Computing", Springer2015. 2. Helio J.C. Barbosa, "Ant Colony Optimization -Techniques and Applications",Intech2013 3. Xin-SheYang, Jao Paulo papa, "Bio-Inspired Computing and Application sinImageProcessing",Elsevier2016 																
ReferenceBooks																
<ol style="list-style-type: none"> 1. Xin-She Yang,"NatureI spired Optimization Algorithm, Elsevier First Edition 2014 2. Yang ,Cui, Xlao, Gandomi, Karamanoglu , "Swarm Intelligence and Bio-Inspired Computing", Elsevier First Edition 2013 																

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
C205-4.1	1			2		2				3					
C205-4.2		1	1		1					2					

C205-4.3		2	2	2										
C205-4.4							2	2						
C205-4.5	2													
C205-4.6	1					3	3							

PROFESSIONAL ELECTIVE-II

21IF2705	DIGITAL IMAGE PROCESSING AND PATTERN RECOGNITION	L	T	P	C
		3	0	0	3
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the knowledge on Signal Processing. 					
Objectives					
<ul style="list-style-type: none"> To understand the basic concepts and algorithms of digital processing. To familiarize the student with the image processing environments like Mat-lab and its equivalent open source Image processing environments. To expose the students To a broad range of image processing techniques and issues and their applications, and To provide the student with practical experiences using them. To appreciate the use of image processing in current technologies and to expose the students to real-world applications of the image processing. 					
UNIT I	FUNDAMENTALS OF IMAGE PROCESSING	9			
Introduction – Elements of visual perception, Steps in Image Processing Systems – Digital Imaging System - Image Acquisition – Sampling and Quantization – Pixel Relationships – File Formats – colour images and models-Image Operations – Arithmetic, logical, statistical and spatial operations.					
UNIT II	IMAGE ENHANCEMENT AND RESTORATION	9			
Image Transforms -Discrete and Fast Fourier Transform and Discrete Cosine Transform , Spatial Domain - Gray level Transformations Histogram Processing Spatial Filtering – Smoothing and Sharpening. Frequency Domain: Filtering in Frequency Domain–Smoothing and Sharpening filters–Homo-morphic Filtering,, Noise models, Constrained and Unconstrained restoration models.					
UNIT III	IMAGE SEGMENTATION AND MORPHOLOGY	9			

Detection of Discontinuities – Edge Operators – Edge Linking and Boundary Detection – Thresholding – Region Based Segmentation – Motion Segmentation, Image Morphology: Binary and Gray level morphology operations - Erosion, Dilation, Opening and Closing Operations – Distance Transforms – Basic morphological Algorithms. Features – Textures – Boundary representations and Descriptions – Component Labeling – Regional descriptors and Feature Selection Techniques.

UNIT IV	INTRODUCTION TO PATTERN RECOGNITION	9
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Component Labeling - Image Features - Textures - Boundary representations and descriptions – Regional descriptors – Feature selection and Feature dimensionality reduction .Image Classification and Recognition - Statistical Classifiers _ Clustering Algorithms – Hierarchical and Partitional clustering

UNIT V	IMAGE PATTERN RECOGNITION CASE STUDIES	9
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Image Understanding – Case Studies in Bio-metrics, Video Processing, Image Fusion - Image Security-Steganography and Water marking - Stereovision - Visual Effects – Image compositing.

Total Periods	45
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Suggestive Assessment Methods

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
<ul style="list-style-type: none"> • Descriptive questions • MCQ 	<ul style="list-style-type: none"> • MCQ • Assignment • Seminar 	<ul style="list-style-type: none"> • Descriptive questions • MCQ

Outcomes

Upon completion of the course ,the students will be able to :

- C206-1.1 The students should be able to implement basic image processing Algorithms using MATLAB Tools
- C206-1.2 Design an application that incorporates different concepts of Image processing
- C206-1.3 Apply and explore new techniques in the areas of image enhancement, restoration, segmentation, compression, wavelet processing and image morphology.
- C206-1.4 Critically analyze different approaches to implements mini projects
- C206-1.5 Explore the possibility of Applying image processing concepts in various domains
- C206-1.6 Apply the pattern recognition concepts in real life problems

Text Books

1. Alasdair Mc Andrew, "Introduction To Digital Image Processing with Matlab", CengageLearning2011, India.
2. AnilJain,"FundamentalsofDigitalImageProcessing",PHI,2011.
3. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education ,2008,NewDelhi.

Reference Books

1. S. Sridhar, "Digital Image Processing", Oxford University Press, 2011, New Delhi.
2. Wilhelm Burger, Mark J Berge, "Digital Image Processing: An algorithmic Introduction using Java", Springer International Edition, 2008.

Web Resources

1. <http://www.imageprocessingplace.com>

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
C206-1.1	3	2	3			3									3
C206-1.2		3	3		2					2					3
C206-1.3	3	3	2	2	2					2					3
C206-1.4		3	3	3						2					3
C206-1.5							2	2		3					3
C206-1.6							3	2	3	3					3

21F2706	GREEN COMPUTING			
	L	T	P	C
	3	0	0	3

Prerequisites for the course

- The students should have the knowledge on data warehousing.

Objectives

1. To learn the fundamentals of Green Computing.
2. To analyze the Green computing Grid Framework.
3. To understand the issues related with Green compliance.
4. To study and develop various case studies.

UNIT I	INTRODUCTION	9
Energy-efficient–power efficient and thermal aware computing and communication -Newton 's Cooling model and basic thermodynamics and sustainability.		
UNIT II	POWER MANAGEMENT	12

Operating system Directed power management – Power management history and motivation – Key power management concepts – power management scenarios – ACPI desktop motherboard design

UNIT III	DEVELOPMENT OF EFFICIENT POWER MANAGEMENT SYSTEM	12
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Dual mode desktop power delivery – system BIOS – Designing mobile systems – Communication with peripheral devices – Drivers – Developing robust power managed applications

UNIT IV	ENERGY EFFICIENT DATA CENTER	12
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Data center power consumption – Power metrics – Energy efficient data center tuning – energy Efficient server management – Industry vision and recommendations

UNIT V	CASE STUDIES	12
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The Environmentally Responsible Business Strategies (ERBS) – Case Study Scenarios for Trial Runs – Case Studies – Applying Green IT Strategies and Applications to a Home, Hospital, Packaging Industry and Telecom Sector.

Total Periods	45
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Suggestive Assessment Methods

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
<ul style="list-style-type: none"> • Descriptive questions • MCQ 	<ul style="list-style-type: none"> • MCQ • Assignment • Seminar 	<ul style="list-style-type: none"> • Descriptive questions • MCQ

Outcomes

Upon completion of the course ,the students will be able to :

- C206-2.1 Acquire knowledge to adopt green computing practices.
- C206-2.2 Enhance the skill in energy saving practices in their use of hardware.
- C206-2.3 Evaluate technology tools that can reduce paper waste and carbon foot print by the stakeholders.
- C206-2.4 Understand the ways to minimize equipment disposal requirements.
- C206-2.5 To minimize negative impacts on the environment.
- C205-2.6 Build an internal cloud

Text Books

1. Jerzy Kolinski, Ram Chary, Andrew Henroid, and Barry Press, “Building the Power Efficient PC A Developer's Guide To ACPI Power Management”, Intel Press August2001.
2. Lauri Minas, Brad Ellison, “Energy Efficiency for Information Technology: How To Reduce Power Consumption in Servers and Data Centers”, Intel Press, 2009.

Reference Books

1. Bhuvan Unhelkar, "Green IT Strategies and Applications-Using Environmental Intelligence", CRC Press, June 2011.
2. Wu Chun Feng, "Green Computing: Large-Scale Energy Efficiency", CRC Press INC, 2013.

Web Resources

1. <http://www.greencomputing.com/>

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
C206-2.1	1		3			3								3	
C206-2.2		2			2				2				3	3	
C206-2.3			1			1		3						3	
C206-2.4				2			3			1			3	3	
C206-2.5			1			2			3					3	
C206-2.6	1				2			3						3	

21IF2707	AGENT BASED INTELLIGENT SYSTEM	L	T	P	C
		3	0	0	3
Prerequisites for the course					
<ul style="list-style-type: none"> The students should have the knowledge on Artificial Intelligence. 					
Objectives					
<ul style="list-style-type: none"> The structure of agents The learning mechanisms of agents The communication and cooperation within agents The design of agents Apply the agents in various types of environments 					
UNIT I	INTRODUCTION	9			
Agents as a paradigm for software engineering – Agents as a Tool for understanding human societies – Intelligent Agent: Agents and Objects – Agents and Expert Systems – Agents as Intentional Systems – Abstract Architectures for Intelligent Agents – How To Tell an Agent What To Do					
UNIT II	LEARNING IN AGENTS	9			
Proportional case – Handling variables and qualifiers – Dealing within tractability – Reasoning with horn clauses – Procedural control of reasoning – Rules in production – Reasoning with Higher order Logics.					
UNIT III	COMMUNICATION AND COOPERATION IN AGENTS	9			
Software Tools for ontology - OWL - XML - KIF - Speech acts - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing - Result Sharing - Combining Task and Result Sharing – Handling Inconsistency - Coordination – Multi agent Planning and Synchronization					
UNIT IV	DEVELOPING INTELLIGENT AGENT SYSTEMS	9			
Situated Agents: Actions and Percepts - Proactive and Reactive Agents: Goals and Events - Challenging Agent Environments: Plans and Beliefs - Social Agents - Agent Execution Cycle - Deciding on the Agent Types - Grouping functionalities - Review Agent Coupling – Acquaintance Diagrams-Develop Agent Descriptors					
UNITV	APPLICATIONS	9			
Agent for workflow and business process management – Mobile agents – Agents for distributed Systems – agents for information retrieval and management – agents for electronic commerce – agent for human – computer interface – agents for virtual environments – agents for social simulation.					

Suggestive Assessment Methods

Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
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- | | | |
|--|--|--|
| <ul style="list-style-type: none"> • Descriptive questions • MCQ | <ul style="list-style-type: none"> • MCQ • Assignment • Seminar | <ul style="list-style-type: none"> • Descriptive questions • MCQ |
|--|--|--|

Outcomes**Upon completion of the course, the students will be able to :**

- C206-3.1 Implement a computational agent with various searching techniques.
- C206-3.2 Use the learning mechanisms for an Artificial agent.
- C206-3.3 Execute different communication and co-operation methodologies in a multi-agent setup
- C206-3.4 Develop the Intelligent agent system to be used in various type of agents
- C206-3.5 Apply the agents to be used in various types of environments
- C206-3.6 Use the agents in virtual environments

Text Books

1. Michael Wooldridge, An Introduction to Multi Agent Systems, Second Edition, John Wiley and Sons, 2009.
2. Stuart Russell, Peter Norvig,—Artificial Intelligence :A Modern Approach||, Third Edition, Pearson Education, 2009.

Reference Books

1. Lin Padgham, Michael Winikoff, Developing Intelligent Agent Systems: A Practical Guide, Wiley publications, 2005
2. Ronald Brachman, Hector Levesque—Knowledge Representation and Reasoning||, The Morgan Kaufmann Series in Artificial Intelligence 2004.

CO Vs. PO Mapping and CO vs. PSO Mapping

C	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS
O	1	2	3	4	5	6	7	8	9	10	11	12	O1	O2	O3
C206-3.1	1		3			3							3	3	3
C206-3.2		2			2				2				3	2	3
C206-3.3			1			1		3					3		3
C206-3.4				2			3			1			3	3	3

C206-3.5			1			2			3				3	3	3
C206-3.6	1				2			3					3		3

21IF2708	INFORMATION RETRIEVAL TECHNIQUES				L	T	P	C	
					3	0	0	3	
Prerequisites for the course									
<ul style="list-style-type: none"> The students should have the knowledge on Data Mining. 									
Objectives									
<ul style="list-style-type: none"> To understand the basics of information retrieval with pertinence To modeling, query operations and indexing To get an understanding of machine learning techniques for text classification and clustering. To understand the various applications of information retrieval giving emphasis to multimedia IR, web search To understand the concepts of digital libraries 									
UNIT I	INTRODUCTION							9	
Basic Concepts – Practical Issues - Retrieval Process – Architecture - Boolean Retrieval – Retrieval Evaluation – Open Source IR Systems–History of Web Search – Web Characteristics– The impact of the web on IR --IR Versus Web Search – Components of a Search engine									
UNIT II	MODELING							9	
Taxonomy and Characterization of IR Models – Boolean Model – Vector Model - Term Weighting – Scoring and Ranking –Language Models – Set Theoretic Models - Probabilistic Models – Algebraic Models – Structured Text Retrieval Models–Models for Browsing.									
UNIT III	INDEXING							9	
Static and Dynamic Inverted Indices – Index Construction and Index Compression. Searching – Sequential Searching and Pattern Matching. Query Operations - QueryLanguages–QueryProcessing-RelevanceFeedbackandQueryExpansion -Automatic Local and Global Analysis – Measuring Effectiveness and Efficiency									
UNIT IV	CLASSIFICATION AND CLUSTERING							9	
Text Classification and Naïve Bayes – Vector Space Classification – Support vector machines and Machine learning on documents. Flat Clustering – Hierarchical Clustering – Matrix decompositions and latent semantic indexing – Fusion and Meta learning									

UNIT V	SEARCHING THE WEB	9
Searching the Web – Structure of the Web–IR and web search – Static and Dynamic Ranking – Web Crawling and Indexing – Link Analysis - XML Retrieval Multimedia IR: Models and Languages – Indexing and Searching Parallel and Distributed IR – Digital Libraries		
Total Periods		45
Suggestive Assessment Methods		
Continuous Assessment Test (30Marks)	Formative Assessment Test (10Marks)	End Semester Exams (60Marks)
<ul style="list-style-type: none"> • Descriptive questions • MCQ 	<ul style="list-style-type: none"> • MCQ • Assignment • Seminar 	<ul style="list-style-type: none"> • Descriptive questions • MCQ
Outcomes		
Upon completion of the course ,the students will be able to :		
C206-4.1	Build an Information Retrieval system using the available Tools	
C206-4.2	Identify and design the various components of an Information Retrieval system	
C206-4.3	Apply machine learning techniques to text classification and clustering which is used for efficient Information Retrieval	
C206-4.4	Design an efficient search engine and analyze the Web content structure	
C206-4.5	Explain the concepts of Indexing, vocabulary, normalization and dictionary in Information retrieval.	
C206-4.6	Understand the issues involved in Providing an IR service on a web scale.	
Text Books		
1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schutze, “Introduction to Information Retrieval”, Cambridge University Press, First South Asian Edition, 2008.		
2. Ricardo Baeza – Yates, Berthier Ribeiro – Ne To , “Modern Information Retrieval: The Concepts and Technology behind Search” (ACM Press Books), Second Edition, 2011.		
Reference Books		
1. Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, “Information Retrieval Implementing and Evaluating Search Engines”, The MIT Press, Cambridge, Massachusetts London, England, 2010.		
Web Resources		
https://blog.netwrix.com/2020/07/02/cloud-data-security/		

CO Vs. PO Mapping and CO vs. PSO Mapping

CO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PS	PS	PS
	1	2	3	4	5	6	7	8	9	10	11	12	01	02	03

C206-4.1	1		1			3						3		3
C206-4.2		2		2					2			3		3
C206-4.3	1		1					3				3		3
C206-4.4			2			3			1			2		3
C206-4.5			1			2			3			3		3
C206-4.6		1			2			3				3		3

PROFESSIONAL ELECTIVE-III

21IF3701	SOCIAL NETWORK ANALYSIS	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> • To understand the components of the social Network • To model and visualize the social network • To mine the users in the w4 • To understand the evolution of the social Network • To know the application s in Real Time Systems 					
Pre – requisite: The students should have the knowledge on Data Mining and web Technology.					
UNIT I	INTRODUCTION				9
Introduction To Web - Limitation s of current Web – Development of Semantic Web – Emergence of the Social Web – Statistical Properties of Social Networks -Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Discussion networks - Blogs and on line communities - Web-based networks					
UNIT II	MODELING AND VISUALIZATION				9
Visualizing Online Social Networks - A Taxonomy of Visualizations - Graph Representation - Centrality- Clustering - Node-Edge Diagrams - Visualizing Social Networks with Matrix-Based Representation s- Node-Link Diagrams - Hybrid Representation s - Modelling and aggregating social network data – Random Walks and their Applications –Use of Hardtop and Map Reduce - On To logical representation of social individuals and relationships.					
UNIT III	MINING COMMUNITIES				9
Aggregating and reasoning with social network data, Advanced Representations – Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Evaluating Communities – Core Methods for Community Detection & Mining - Application s of Community Mining Algorithms - Node Classification in Social Networks.					
UNIT IV	EVOLUTION				9
Evolution in Social Networks – Framework - Tracing Smoothly Evolving Communities - Models and Algorithms for Social Influence Analysis - Influence Related Statistics - Social Similarity and Influence - Influence Maximization in Viral Marketing - Algorithms and					

Systems for Expert Location in Social Networks - Expert Location without Graph Constraints - with Score Propagation – Expert Team Formation - Link Prediction in Social Networks - Feature based Link Prediction – Bayesian Probabilistic Models - Probabilistic Relational Models

UNIT V	APPLICATIONS	9
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A Learning Based Approach for Real Time Emotion Classification of Tweets, A New Linguistic Approach To Assess the Opinion of Users in Social Network Environments, Explaining Scientific and Technical Emergence Forecasting, Social Network Analysis for Biometric Template Protection

Total Periods: 45

Reference(s):

1. Ajith Abraham, Aboul Ella Hassanien, Václav Snášel, “Computational Social Network Analysis: Trends, Tools and Research Advances”, Springer, 2012
2. Borko Furht, “Handbook of Social Network Technologies and Applications”, Springer, 1st edition, 2011
3. Charu C. Aggarwal, “Social Network Data Analytics”, Springer; 2014
4. Giles, Mark Smith, John Yen, “Advances in Social Network Mining and Analysis”, Springer, 2010
5. Guandong Xu, Yanchun Zhang and Lin Li, “Web Mining and Social Networking – Techniques and Applications”, Springer, 1st edition, 2012
6. Peter Mika, “Social Networks and the Semantic Web”, Springer, 1st edition, 2007.
7. Przemyslaw Kazienko, Nitesh Chawla, “Applications of Social Media and Social Network Analysis”, Springer, 2015

Course Outcomes:

Upon the completion of the course the student should be able To

- C301.1 Work on the internal components of the social network
- C301.2 Model and visualize the social network
- C301.3 Mine the behaviour of the users in the social network
- C301.4 Apply social network in real time application.
- C301.5 Predict the possible next outcome of the social network
- C301.6 Describe the applications involved in real time systems

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C301.1	3		2			3				

C301.2		1			2			2	
C301.3			2			3		3	
C301.4	3			2			3		1
C301.5			3			2		3	
C301.6					2			3	

1 → Low, 2 → Medium, 3 → High

21IF3702	MOBILE APPLICATION DEVELOPMENT	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> Understand system requirements for mobile applications Generate suitable design using specific mobile development frameworks Generate mobile application design Implement the design using specific mobile development frameworks Deploy the mobile applications in marketplace for distribution 					
Pre – requisite: The students should have the knowledge on Mobile computing and Java Programming.					
UNIT I	INTRODUCTION	9			
Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications.					
UNIT II	BASIC DESIGN	9			
Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – To such events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.					
UNIT III	ADVANCED DESIGN	9			
Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.					
UNIT IV	ANDROID	9			
Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and					

deployment – Interaction with server side applications – Using Google Maps, GPS and Wi-Fi – Integration with social media applications.

UNIT V	IOS	9
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Introduction to Objective C – iOS features – UI implementation – To such frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wi-Fi - iPhone marketplace.

Total Periods: 45

Reference(s):

1. Charlie Collins, Michael Gal pin and Matthias Kipper, “Android in Practice”, Dream Tech, 2012.
2. David Mark, Jack Nutting, Jeff LA Marché and Frederic Olsson, “Beginning iOS 6 Development: Exploring the iOS SDK”, A press, 2013.
3. <http://developer.android.com/develop/index.html>.
4. James Dove and Ash Furrow, “Beginning Objective C”, a press, 2012.
5. Jeff Mc Wherter and Scott Go well, "Professional Mobile Application Development", Wrox, 2012.
6. Recto Meier, “Professional android Development”, Wiley-India Edition, 2012.

Course Outcomes:

Upon the completion of the course the student should be able To

- C302.1 Describe the requirements for mobile application s
- C302.2 Explain the challenges in mobile application design and development
- C302.3 Develop design for mobile application s for specific requirements
- C302.4 Implement the design using Android SDK
- C302.5 Implement the design using Objective C and iOS
- C302.6 Deploy mobile application s in Android and iPhone marketplace for distribution

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C302.1	3		3			3				
C302.2		3			3				2	
C302.3			1			2		3		

C302.4				3			3			3
C302.5			3			3			3	
C302.6	1				2			3		

1 → Low, 2 → Medium, 3 → High

21IF3703	VIDEO ANALYTICS	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To know the fundamental concepts of big data and analytics To learn various techniques for mining data streams To acquire the knowledge of extracting information from surveillance videos. To learn Event Modelling for different applications. To understand the models used for recognition of objects in videos. 					
UNIT I	INTRODUCTION TO BIG DATA & DATA ANALYSIS	9			
Introduction To Big Data Platform – Challenges of Conventional systems – Web data-Evolution of Analytic scalability- analytic processes and Tools- Analysis Vs. Reporting- Modern data analytic Tools- Data Analysis: Regression Modelling- Bayesian Modelling- Rule induction .					
UNIT II	MINING DATA STREAMS	9			
Introduction To Stream concepts- Stream data model and architecture – Stream Computing- Sampling data in a Stream- Filtering Streams- Counting distinct elements in a Stream- Estimating moments- Counting oneness in a window- Decaying window- Real time Analytics platform (RTAP) applications - case studies.					
UNIT III	VIDEO ANALYTICS	9			
Introduction - Video Basics - Fundamentals for Video Surveillance- Scene Artifacts - Object Detection and Tracking: Adaptive Background Modelling and Subtraction - Pedestrian Detection and Tracking- Vehicle Detection and Tracking- Articulated Human Motion Tracking in Low-Dimensional Latent Spaces.					
UNIT IV	BEHAVIOURAL ANALYSIS & ACTIVITY RECOGNITION	9			
Event Modelling- Behavioural Analysis- Human Activity Recognition - Complex Activity Recognition - Activity modelling using 3D shape, Video summarization, and shape based activity models- Suspicious Activity Detection.					
UNIT V	HUMAN FACE RECOGNITION & GAIT ANALYSIS	9			

Introduction : Overview of Recognition algorithms – Human Recognition using Face: Face Recognition from still images, Face Recognition from video, Evaluation of Face Recognition Technologies- Human Recognition using gait: HMM Framework for Gait Recognition , View Invariant Gait Recognition , Role of Shape and Dynamics in Gait Recognition .

Total Periods: 45

Reference(s):

1. Anand Raja Raman and Jeffrey David Ullman, Mining of Massive Datasets, Cambridge University Press, 2012.
2. Michael Berthold, David J.Hand, Intelligent Data Analysis, Springer, 2007.
3. Rama Chellappa, Amit K.Roy-Chowdhury, Kevin Zhou's, "Recognition of Humans and their Activities using Video", Morgan Claypool Publishers, 2005.
4. Yunqian Ma, Gang Qi an, "Intelligent Video Surveillance: Systems and Technology", CRC Press (Taylor and Francis Group), 2009.

Course Outcomes:

Upon the completion of the course the student should be able To

- C302.1 Work with big data platform and its analysis techniques.
- C302.2 Design efficient algorithms for mining the data from large volumes
- C302.3 Work with surveillance videos for analytics
- C302.4 Design of optimization algorithms for better analysis and recognition of objects in a scene
- C302.5 Model a framework for Human Activity Recognition
- C302.6 Understand the concepts in **Human Face Recognition & Gait Analysis**

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C302.1	3	2	3	2	2			2		3
C302.2	3	3	3	1	2			3		3
C302.3	2		2	1	3					3
C302.4	2	2	3	2	3	1		2	2	3
C302.5	2	1	3	2	3	1	1		2	3

C302.6	2	3	3	1	3	2	2	1	1	3
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1 → Low, 2 → Medium, 3 → High

21IF3704	DEEP LEARNING	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To present the mathematical, statistical and computational challenges of building neural networks To study the concepts of deep learning To introduce dimensionality reduction techniques To enable the students To know deep learning techniques To support real-time applications To examine the case studies of deep learning techniques 					
UNIT I	INTRODUCTION				9
Introduction To machine learning- Linear models (SVMs and Perceptrons, logistic regression)- Intro To Neural Nets: What a shallow network computes- Training a network: loss functions, back propagation and stochastic gradient descent- Neural networks as universal function approximates					
UNIT II	DEEP NETWORKS				9
History of Deep Learning- A Probabilistic Theory of Deep Learning- Back propagation and regularization, batch normalization - VC Dimension and Neural Nets-Deep Vs. Shallow Networks- Convolutional Networks - Generative Adversarial Networks (GAN), Semi-supervised Learning					
UNIT III	DIMENSIONALITY REDUCTION				9
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction To Convnet - Architectures – Alex Net, VGG, Inception , Res Net - Training a Convnet: weights initialization , batch normalization , hyper parameter optimization .					
UNIT IV	OPTIMIZATION AND GENERALIZATION				9
Optimization in deep learning– Non-convex optimization for deep networks- Stochastic Optimization - Generalization in neural networks- Spatial Transformer Networks- Recurrent networks, LSTM - Recurrent Neural Network Language Models- Word-Level					

RNNs & Deep Reinforcement Learning - Computational & Artificial Neuroscience.

UNIT V **CASE STUDY AND APPLICATION S** **9**

Image net- Detection -Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection - Bio-Informatics- Face Recognition - Scene Understanding- Gathering Image Captions

Total Periods: 45**Reference(s):**

1. Cosma Rohilla Shalizi, Advanced Data Analysis from an Elementary Point of View, 2015.
2. Deng & Yu, Deep Learning: Methods and Applications, Now Publishers, 2013.
3. Ian Good fellow, Yoshua Bagnio, Aaron Carville, Deep Learning, MIT Press, 2016.
Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015.

Course Outcomes:**Upon the completion of the course the student should be able To**

- C302.1 Understand basics of deep learning
- C302.2 Implement various deep learning models
- C302.3 Realign high dimension al data using reduction techniques
- C302.4 Analyse optimization in deep learning
- C302.5 Analyse generalization in deep learning
- C302.6 Explore the deep learning application s

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C302.1	2	2					2			3
C302.2	2	2	2	2			2			2
C302.3	2		2	2				2		2
C302.4	2		2	2				2	2	3
C302.5	2								2	3
C302.6	2		2	2				2		

1 → Low, 2 → Medium, 3 → High

PROFESSIONAL ELECTIVE-IV

21IF3705	AUTO MATA THEORY AND FORMAL LANGUAGES	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To know the formal relationships between machines, languages and grammar. To construct automata for any given word pattern and find its equivalent regular expressions To design grammars for recognizing the syntax of any given language To understand the need for designing Turing machines and their capability To have the capability To solve un-decidable problems and NP problems 					
UNIT I	REGULAR EXPRESSION S AND LANGUAGES	9			
Introduction to Formal Proof – Additional Forms of proof – Inductive proofs – Proof by Contradiction - Regular Expressions – Regular and Non Regular Languages - Closure Properties of Regular Languages - Proving Languages Not To Be Regular - Decision Properties of Regular Languages.					
UNIT II	AUTO MATA	9			
Finite Automata – Deterministic Finite Automata – Non -deterministic Finite Automata – Finite Automata with Epsilon Transitions – Kleenex’s Theorem –Equivalence and Minimization of Automata - Finite Automata and Regular Expressions.					
UNIT III	CON TEXT-FREE GRAMMARS AND LANGUAGES	9			
Context-Free Grammars – Parse Trees – Ambiguity in Grammars and Languages – Normal forms for Context-Free Grammars – Pumping Lemma for Context-Free Languages - Closure and Decision Properties of Context-Free Languages - Phases of a compiler - Lexical Analysis – Parsing – Compiler Design using Lexical Analysis and Parsing – Grammars for Natural Language Processing.					
UNIT IV	PUSHDOWN AUTO MATA AND TURING MACHINES	9			
Definition – Languages of a Pushdown Automata – Equivalence of Pushdown Automata and Con text- Free Grammars - Deterministic Pushdown Automata - Turing Machines – Programming Techniques for Turing Machines - Basic Turing Machine Extension s.					
UNIT V	UNDECIDABILITY	9			
Not Recursively Enumerable Language – Recursively Enumerable Un-decidable problem–					

Un-decidable Problems about Turing Machines – Post’s Correspondence Problem - The classes P and NP - NP- complete problems.

Total Periods: 45

Reference(s):

1. Alfred V. Ahoy, Monica S. Lam, Ravi Seth, and Jeffrey D. Ullman, “Compilers: Principles, Techniques, & Tools”, Second Edition Boston: Addison -Wesley, 2007.
2. H.R.Lewis and C.H.Papadimitriou, “Elements of The theory of Computation”, Second Edition, Pearson Education /PHI, 2003.
3. J.E.Hopcroft, R.Motwani and J.D Ullman, “Introduction to Automata Theory, Languages and Computations”, Third Edition, Pearson Education, 2007.
4. J. Martin, “Introduction to Languages and the Theory of Computation”, Third Edition, TMH, 2003.
5. Michael Sipper, “Introduction of the Theory and Computation”, Thomson Borecole, 1997.

Course Outcomes:

Upon the completion of the course the student should be able To

- C302.1 Construct Automata for a language and regular expression for any pattern.
 C302.2 Construct Automata for regular expression for any pattern.
 C302.3 Write Context free grammar for any construct and perform syntax analysis
 C302.4 Design Push down Automata for any language and solve problems
 C302.5 Propose computation solutions using Turing machines.
 C302.6 Derive whether a problem is decidable or not

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C302.1	2	2	2							3
C302.2	2	2				2	2			3
C302.3	2	2	3	2	2		2			3
C302.4	2	2	3		2	2			2	3
C302.5		2	3							3
C302.6		2								

1 → Low, 2 → Medium, 3 → High

21IF3706	GPU ARCHITECTURE AND PROGRAMMING	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To understand the architecture of GPUs in order To program the m effectively. To program using GPU programming frameworks. To optimize multimedia application s To run on GPUs 					
UNIT I	GPU ARCHITECTURES				9
Parallel Processors – Classification – Performance – Multimedia SIMD Architectures. GPU – NVIDIA Case Study – GPU Computational Structures – ISA – Memory Structures.					
UNIT II	GPU COMPUTING AND CUDA				9
Introduction – Parallel Programming Languages and models – Evolution of Graphic pipelines – GPGPUs - CUDA Program Structure – Device memories – Data Transfer – Kernel Function s					
UNIT III	CUDA				9
CUDA Threads - thread Organization – Synchronization & Scalability – CUDA memories – Performance					
UNIT IV	OPENCL BASICS				9
Open CL Standard – Kernels – Host Device Interaction – Execution Environment – Memory Model – Basic Open CL Examples					
UNIT V	OPENCL CON CURRENCY & EXECUTION MODEL				9
Open CL Synchronization – Kernels – Fences – Barriers – Queuing – Global Synchronization – Memory Consistency – Events – Host side memory model – Device Side memory Model – Case study					
Total Periods: 45					
Reference(s):					
<ol style="list-style-type: none"> B.R. Gagster, L. Howe’s, D.R. Kael, P. Misty, D. Schwa, “ Heterogeneous computing with Open CL”, Morgan Kauffman, 2012 David B. Kirk, Wen-mei W. Hwu, “Programming massively parallel processors”, Morgan Kauffman, 2010. John L. Hennessey and David A. Patterson, “Computer Architecture –A quantitative 					

approach”, Morgan Kaufmann / Elsevier, 5th edition, 2012.

4. J. Sanders and E. Kandrot, “CUDA by Example: An Introduction to General-Purpose GPU Programming”, Addison Wesley, 2010.
5. Wen–mei W. Hwu, “GPU Computing Gems”, Morgan Kaufmann / Elsevier, 2011Brokecole, 1997.

Course Outcomes:

Upon the completion of the course the student should be able To

- C302.1 Understand the concepts about GPU architecture
- C302.2 Analyse the GPU Computing and CUDA
- C302.3 Validate GPU Computing and CUDA
- C302.4 Develop multimedia application s using GPUs
- C302.5 Understand the basics on OPENCL
- C302.6 Implement the real world application s using OPENCL

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C302.1	3								2	
C302.2	3	3	2		2	2	3			
C302.3	3	3	3	3	2		2		3	2
C302.4	3	3	3	3	2		2		3	2
C302.5	3							2		3
C302.6	3	3	3	3	2		2	2	3	2

1 → Low, 2 → Medium, 3 → High

21IF3707	CYBER LAWS AND SECURITY POLICIES	L	T	P	C
		3	0	0	3

Objectives:

- To enable the learner to understand, explore, acquire and understanding of Cyber Law.
- To develop the competencies for identifying frauds and deceptions (confidence tricks, scams) and other cybercrimes.
- To examine how the online digital world has been inflicted with new cybercrimes, implications for society and law enforcement response.

- To investigating how the computer and electronic devices have become both a target of attack and a Tool for criminal activity.

Pre-requisite of course: Fundamentals of Computer Network, Network Security, Internet Technology.

UNIT I	INTRODUCTION OF CYBER LAWS	9
Indian Information Technology Act, as amended up To data - rules framed under the Act; in particular, the rules relating To regulation of cyber cafes, certification authority and digital signature and other commercially significant aspects – selected comparative cyber laws in other countries.		
UNIT II	CYBERCRIME MOBILE & WIRELESS DEVICES	9
What is Cybercrime? Forgery, Hacking, Software Piracy, Computer Network Intrusion How Criminals Plan Attacks, Passive Attack, Active Attacks, Cyber stalking. Security challenges posted by mobile devices, cryptographic security for mobile devices, Attacks on mobile/cell phones, Theft, Virus, Hacking. Bluetooth; Different viruses on laptop.		
UNIT III	TOOLS AND METHODS USED IN CYBER CRIME	9
Proxy servers, Password checking, Random checking, Trojan Horses and Backdoors; DOS & DDOS attacks; SQL injection: Buffer over flow.		
UNIT IV	ELECTRON IC BUSINESS AND LEGAL ISSUES	9
Electronic Business and legal issues Legal issues in Evolution and development in E-commerce, paper vs. paper less contracts E-Commerce models- B2B, B2C,E security		
UNIT V	CYBERCRIME & CYBERSECURITY	9
Phishing methods, ID Theft; Online identity method. Legal aspects, Indian laws, IT act, Public key certificate		
Total Periods: 45		
Reference(s):		
<ol style="list-style-type: none"> Cyber security by Nina Goole & Sunit Belapune; Pub: Wiley India Handbook of Cyber Laws, by Vakul Sharma, MacMillan. Cyber law by Nandan Klamath, Fifth Edition , Universal law Publication , 01 Jan 2012 Computers, Technology and the new internet laws by Karnika Seth, Updated Edition, Lexis nexis Publication, 01 Jan 2013. 		

Course Outcomes:

Upon the completion of the course the student should be able To

- C307.1 Analyse various types of cybercrime and formulate procedures for real world cybercrime Investigations
- C307.2 Resolve challenges posed To law enforcement agents, policy makers and prosecutors
- C307.3 Use and Analyse the software Tools and methods currently available for finding illegal activities on computer disks and in computer networks.
- C307.4 Analyse the criminal activity on the Internet and propose available Tools To prevent such activity.
- C307.5 Find solutions in cybercrime investigations, evidence and applicable law for real world case studies.
- C307.6 Study the cyber laws in different countries

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C307.1		3	3	3						
C307.2		3		3					3	
C307.3		3	3	3						3
C307.4		3	2	3						
C307.5		3		3					3	
C307.6	3				3			3		3

1 → Low, 2 → Medium, 3 → High

21IF3708	TRUST NETWORKS	L	T	P	C
		3	0	0	3

Objectives:

- To understand trust networks
- To learn how decentralization of trust is achieved
- To study the technologies behind crypto currencies
- To impart knowledge in block chain network mining
- To acquire knowledge in emerging concepts using block chain

Pre-requisite of course: Fundamentals of Computer Network, Network Security, Internet Technology.		
UNIT I	TRUST NETWORKS	9
Technical and Business Imperatives – Trust Networks To enable the machine economy – Decentralization of Trust – Technologies Block chain and Crypto currency		
UNIT II	DECENTRALIZATION OF NETWORK	9
Centralization Vs. Decentralization – Building Consensus – Distributed Consensus – Consensus Algorithm – Consensus without Identity- Incentives and Proof of Work –Forming the Decentralized Network		
UNIT III	BLOCKCHAIN	9
Block chain the protocol – Types of Block chain Networks – Design principles of the Block chain economy – Networked Integrity – Distributed power – Value as Incentive – Security and Privacy – Rights and Inclusion – Distributed Ledger – Non Repudiation		
UNIT IV	CRYPTO CURRENCIES	9
Cryptographic Hash Functions – Cryptography basics and Concepts – Bit coin – Digital Signatures as Identities – e-Wallets – Personal Crypto security - Bit coin Mining – Mining Hardware – Energy Consumption – Mining Pools – Mining Incentives and Strategies		
UNIT V	EMERGING CONCEPTS AND FRAMEWORKS	9
Smart Contracts – Ethereum, Hyper ledger, Multi chain Frameworks – Solidity Programming Language – Block chain with IOT and Cloud		
Total Periods: 45		
Reference(s):		
<ol style="list-style-type: none"> 1. Don and Alex Tap Scott, “Block chain Revolution”. Portfolio Penguin 2016. 2. William Magyar, “Business Block chain Promise, Practice and Application of the Next Internet Technology, John Wiley & Sons 2016. 		
Course Outcomes:		
Upon the completion of the course the student should be able To		
C308.1	Realize the importance of trust networks	
C308.2	Comprehend the challenges and design issues in bit coin technology	
C308.3	Analyse the algorithms developed for bit coin mining	

C308.4	Use appropriate techniques for designing trust-based business networks
C308.5	To securely interact with the m,
C308.6	Integrate ideas from block chain technology into their own projects.

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C308.1	3									
C308.2	3		3	2						
C308.3		3								
C308.4			3	2	3	2			3	2
C308.5		2			2			2		
C308.6			2	3	3	2	2		3	

1 → Low, 2 → Medium, 3 → High

PROFESSIONAL ELECTIVE-V

21IF3709	WIRELESS ADHOC AND SENSOR NETWORKS	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To understand the basics of Ad-hoc & Sensor Networks. To learn various fundamental and emerging protocols of all layers. To study about the issues pertaining to major obstacles in establishment and efficient management of Ad-hoc and sensor networks. To understand the nature and applications of Ad-hoc and sensor networks. To understand various security practices and protocols of Ad-hoc and Sensor Networks. 					
Pre-requisite of course: Fundamentals of Computer Network, Network Security, Wireless Network.					
UNIT I	MAC & TCP IN AD HOC NETWORKS				9
Fundamentals of WLANs – IEEE 802.11 Architecture - Self configuration and Auto-configuration - Issues in Ad-Hoc Wireless Networks – MAC Protocols for Ad-Hoc Wireless					

Networks – Contention Based Protocols - TCP over Ad-Hoc networks-TCP protocol overview - TCP and MANETs – Solutions for TCP over Ad-Hoc Networks.		
UNIT II	ROUTING IN AD HOC NETWORKS	9
Routing in Ad-Hoc Networks- Introduction -Topology based versus Position based Approaches- Proactive, Reactive, Hybrid Routing Approach-Principles and issues – Location services - DREAM – Quorums based location service – Grid – Forwarding strategies – Greedy packet forwarding – Restricted directional flooding- Hierarchical Routing- Issues and Challenges in providing QoS.		
UNIT III	MAC, ROUTING & QOS IN WIRELESS SENSOR NETWORKS	9
Introduction – Architecture - Single node architecture – Sensor network design considerations – Energy Efficient Design principles for WSNs – Protocols for WSN – Physical Layer : Transceiver Design considerations – MAC Layer Protocols – IEEE 802.15.4 Zigbee – Link Layer and Error Control issues - Routing Protocols – Mobile Nodes and Mobile Robots - Data Centric & Contention Based Networking – Transport Protocols & QOS – Congestion Control issues – Application Layer support.		
UNIT IV	SENSOR MANAGEMENT	9
Sensor Management - Topology Control Protocols and Sensing Mode Selection Protocols - Time synchronization - Localization and positioning – Operating systems and Sensor Network programming – Sensor Network Simulators.		
UNIT V	SECURITY IN AD HOC AND SENSOR NETWORKS	9
Security in Ad-Hoc and Sensor networks – Key Distribution and Management – Software based Anti- tamper techniques – water marking techniques – Defense against routing attacks - Secure Ad hoc routing protocols – Broadcast authentication WSN protocols – TESLA – Biba – Sensor Network Security Protocols – SPINS.		
Total Periods: 45		
Reference(s):		
<ol style="list-style-type: none"> 1. Adrian Perrig, J. D. Tygar, "Secure Broadcast Communication: In Wired and Wireless Networks", Springer, 2006. 2. C.K.To h, “Ad Hoc Mobile Wireless Networks”, Pearson Education, 2002. 3. C.Siva Ram Murthy and B.S.Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Pearson Education, 2004. 4. Carlos De Moraes Cordeiro, Dharma Prakash Agrawal “Ad Hoc and Sensor 		

Networks: Theory and Applications (2nd Edition), World Scientific Publishing, 2011.

5. Erdal Çayırıcı, Chunming Rong, “Security in Wireless Ad Hoc and Sensor Networks”, John Wiley and Sons, 2009.
6. Holger Karl, Andrea’s willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley & Sons, Inc.2005.
7. Subir Kumar Sarkar, T G Basavaraju, C Puttamadappa, “Ad Hoc Mobile Wireless Networks”, Auer Bach Publications, 2008.
8. Waltenegus Darcie, Christian Poellabauer Wireless Sensor Networks Theory and Practice”, John Wiley and Sons, 2010.

Course Outcomes:

Upon the completion of the course the student should be able To

- C309.1 Identify different issues in wireless ad hoc and sensor networks.
- C309.2 To analyse protocols developed for ad hoc and sensor networks.
- C309.3 To identify and address the security threats in ad hoc and sensor networks.
- C309.4 Design the various routing protocols for Ad hoc networks
- C309.5 Emphasis knowledge in various functional areas such as Physical Layer, MAC Layer & Application Layer of Sensor Networks
- C309.6 Establish a Sensor network environment for different type of applications.

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C309.1		2		3					2	
C309.2	2	3		2						
C309.3	3	3		3	2		2		3	3
C309.4	3		3			2			3	
C309.5	3		2			3		2		
C309.6	3			3			3		3	3

1 → Low, 2 → Medium, 3 → High

21IF3710	SOFTWARE TESTING AND QUALITY ASSURANCE	L	T	P	C
		3	0	0	3
Objectives: <ul style="list-style-type: none"> • Introduce basic concepts of software testing • Understand white box, block box, object oriented, web based and cloud testing • Know in details automation testing and Tools used for automation testing • Understand the importance of software quality and assurance software systems development. 					
UNIT I	INTRODUCTION				9
<p>Introduction , historical perspective, Definition , Core Components, Quality View, Financial Aspect, Customers suppliers and process, Total Quality Management(TQM), Quality practices of TQM, Quality Management through- Statistical process Control, Cultural Changes, Continual Improvement cycle, quality in different areas, Benchmarking and metrics, Problem Solving Techniques, Problem Solving Software Tools. Software Quality- Introduction , Constraints of Software product Quality assessment, Customer is a King, Quality and Productivity Relationship, Requirements of Product, Organization Culture, Characteristics of Software, Software Development Process, Types of Product, Criticality Definition s, Problematic areas of SDLC, Software Quality Management, Why Software has defects, Processes related To Software Quality, Quality Management System's Structure, Pillars of Quality Management System, Important aspects of quality management.</p>					
UNIT II	TEST PLANNING AND MANAGEMENT				9
<p>Review of Fundamentals of Software Testing, Testing during development life cycle, Requirement Traceability matrix, essentials, Work bench, Important Features of Testing Process, Misconceptions, Principles, salient and policy of Software testing, Test Strategy, Test Planning, Testing Process and number of defects found, Test team efficiency, Mutation testing, challenges, test team approach, Process problem faced, Cost aspect, establishing testing policy, methods, structured approach, categories of defect, Defect/ error/ mistake in software, Developing Test Strategy and Plan, Testing process, Attitude Towards testing, approaches, challenges, Raising management awareness for testing, skills required by tester</p>					
UNIT III	SOFTWARE TEST AUTOMATION AND SELENIUM TOOL				9
<p>What is Test Automation , Terms used in automation , Skills needed for automation , What To automate, scope of automation , Design and Architecture of automation , Generic</p>					

requirement for Test Tool, Process Model for Automation , Selecting Test Tool, Automation for XP/Agile model, Challenges in Automation , Data-driven Testing. Automation Tools like JUnit, Jmeter. Introducing Selenium, Brief History of The Selenium Project, Selenium's Tool Suite, Selenium IDE, Selenium RC, Selenium Web driver, Selenium Grid, Test Design Considerations

UNIT IV	QUALITY MANAGEMENT	9
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Software Quality, Software Quality Dilemma, Achieving Software Quality, Software Quality Assurance. Elements of SQA, SQA Tasks, Goals, and Metrics, Formal Approaches To SQA, Statistical Software Quality Assurance, Six Sigma for Software Engineering, ISO 9000 Quality Standards, SQA Plan

UNIT V	SOFTWARE QUALITY TOOLS	9
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Total Quality Management, Product Quality Metrics, In process Quality Metrics, Software maintenance, Ishikawa's 7 basic Tools, Checklists, Pareto diagrams, Histogram, Run Charts, Scatter diagrams, Control chart, Cause Effect diagram. Defect Removal Effectiveness and Process Maturity Level.

Total Periods: 45

Reference(s):

1. M G Limaye, "Software Testing Principles, Techniques and Tools", Tata McGraw Hill, ISBN: 9780070139909 0070139903
2. Srinivasan Desikan, Gopalswamy Ramesh, "Software Testing Principles and Practices", Pearson, ISBN-10: 817758121X.
3. Naresh Chauhan, "Software Testing Principles and Practices ", OXFORD, ISBN-10: 0198061846. ISBN-13: 9780198061847
4. Stephen Kan, "Metrics and Models in Software Quality Engineering", Pearson , ISBN-10: 0133988082; ISBN-13: 978-0133988086

Course Outcomes:

Upon the completion of the course the student should be able To

- | | |
|--------|--|
| C309.1 | Describe fundamental concepts in software testing such as manual testing, automation testing and software quality assurance. |
| C309.2 | Design and develop project test plan, design test cases, test data, and conduct test operations |
| C309.3 | Apply recent automation Tool for various software testing for testing software |

- C309.4 Apply different approaches of quality management, assurance, and quality standard To software system
- C309.5 Apply and analyze effectiveness Software Quality Tools
- C309.6 Understand the various software Tools used in software testing.

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C309.1	2		2							
C309.2		2		3	2				2	
C309.3	1		3			3		3		
C309.4		3		2	3		3			3
C309.5									3	
C309.6	3							3		

1 → Low, 2 → Medium, 3 → High

21IF3711	DESIGN THINKING	L	T	P	C
		3	0	0	3

Objectives:

- To introduce the idea of design thinking in product development
- To understand the practice of design thinking
- To leverage use of Tools for the design process
- To learn the application of design thinking for the IT industry
- To design using the methodology

Pre-requisite of course :

UNIT I	INTRODUCTION	9
Design thinking – Shared model in team based design – Theory and practice in Design thinking – Exploring work of Designers across globe – MVP or Prototyping		
UNIT II	Tools for Design Thinking	9
Real-Time design interaction capture and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design		
UNIT III	Design Thinking in IT	9
Design Thinking To Business Process modelling – Agile in Virtual collaboration		

environment – Scenario based Prototyping										
UNIT IV										9
DT For strategic innovations - Growth – Story telling - Predictability – Strategic Foresight - Change – Sense Making - Maintenance Relevance – Value redefinition - Extreme Competition – experience design - Standardization – Humanization - Creative Culture – Rapid prototyping, Strategy and Organization – Business Model design.										
UNIT V										9
Design Thinking Work shop Empathize, Design, Ideate, Prototype and Test.										
Total Periods: 45										
Reference(s):										
<ol style="list-style-type: none"> "The Design of Business: Why Design Thinking is the Next Competitive Advantage", 2009. "Design Thinking: Understand – Improve – Apply", 2011 (Unit III). "Design Thinking for Strategic Innovation : What The y Can't Teach You at Business or Design School", 2013. (Unit IV). https://dschool.stanford.edu/use-our-methods/ https://www.interaction-design.org/literature/article/5-stages-in-the-design-thinking-process http://www.creativityatwork.com/design-thinking-strategy-for-innovation/ 										
Course Outcomes:										
Upon the completion of the course the student should be able to										
C309.1	Apply design thinking for product development.									
C309.2	Use design thinking Tools									
C309.3	Identify need for products and disruption									
C309.4	Design innovative products									
C309.5	Apply design thinking To improve on existing products in IT & Facilitate design thinking workshop									
C309.6	Facilitate design thinking workshop									
PO vs. CO Mapping										

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C309.1	2			2						2
C309.2	2			2					2	2

C309.3	2				2	2				2
C309.4	2	2	2		2	2			2	3
C309.5		2	2	2						2
C309.6		2								2

1 → Low, 2 → Medium, 3 → High

21IF3712	FORECASTING AND OPTIMIZATION	L	T	P	C
		3	0	0	3
Objectives:					
<ul style="list-style-type: none"> To provide a comprehensive introduction of the forecasting methods To study the various regression models and perform for forecasting To understand the autoregressive models and its variants for forecasting To get an overview of various numerical methods of optimization To get an insight into advanced optimization techniques. 					
Pre-requisite of course :					
UNIT I	INTRODUCTION TO FORECASTING				9
The Nature and Uses of Forecasts- The Forecasting Process- Resources for Forecasting- Types of Forecasting Techniques - Graphical Displays- Time Series Plots- Plotting Smoothed Data- Numerical Description of Time Series Data- Stationary Time Series- Auto covariance and Auto correlation Functions- Use of Data Transformations and Adjustments- Transformations- Trend and Seasonal Adjustments- General Approach To Time Series Modelling and Forecasting- Evaluating and Monitoring Forecasting Model Performance - Forecasting Model Evaluation - Choosing Between Competing Models- Monitoring a Forecasting Model					
UNIT II	REGRESSION ANALYSIS AND FORECASTING				9
Least Squares Estimation in Linear Regression Models. Statistical Inference in Linear Regression. Test for Significance of Regression - Tests on Individual Regression Coefficients and Groups of Coefficients- Confidence Intervals on Individual Regression Coefficients. Confidence Intervals on the Mean Response. Prediction of New Observations. Model Adequacy Checking- Residual Plots- Scaled Residuals and PRESS. Measures of Leverage and Influence- Variable Selection Methods in Regression - Generalized and Weighted Least Squares. Generalized Least Squares. Weighted Least Squares- Discounted Least Squares. Regression Models for General Time Series Data- Detecting Auto					

correlation : The Durbin-Watson Test- Outliers- Multi-collinearity- Heteroskedasticity- Auto correlation and Structural Breaks- Estimating the Parameters in Time Series Regression Models		
UNIT III	AUTO REGRESSIVE INTEGRATED MOVING AVERAGE (ARIMA) AND OTHER MODELS	9
First Order Exponential Smoothing- Second Order Exponential Smoothing- Higher Order Exponential Smoothing- Exponential Smoothing for Seasonal Data- Linear Models for Stationary Time Series- Finite Order Moving Average (MA) Processes- Finite Order Autoregressive Processes- Mixed Autoregressive-Moving Average Processes- Non stationary Processes- Time Series Model Building- Forecasting ARIMA Processes- Seasonal Processes- Exponential Smoothers and ARIMA Models- Multivariate Stationary Process- Vector ARIMA Models- Vector AR (VAR) Models- State Space Models- ARCH and GARCH Models- Direct Forecasting of Percentiles-Neural Networks and Forecasting		
UNIT IV	NUMERICAL METHODS OF OPTIMIZATION	9
What is optimization? -Linear programming- Integer programming- Quadratic programming- Non-linear programming- Stochastic programming- Dynamic programming- Combinatorial optimization - Infinite-dimensional optimization - Constraint satisfaction .		
UNIT V	ADVANCED OPTIMIZATION TECHNIQUES AND ASPECTS OF OPTIMIZATION	9
Hill climbing- simulated annealing- genetic algorithm- Ant colony- Optimization of Fuzzy Systems- Neural-Network-Based Optimization - Reduction of Size of an Optimization Problem- Fast Reanalysis Techniques- Derivatives of Static Displacements and Stresses- Derivatives of Eigen values and Eigen vectors- Derivatives of Transient Response- Sensitivity of Optimum Solution To Problem Parameters- Multilevel Optimization - Parallel Processing- Multi objective Optimization .		
Total Periods: 45		
Reference(s):		
<ol style="list-style-type: none"> 1. C. B. Gupta, "Optimization Techniques in Operation Research".I.K. International Publishing House, Pvt Ltd., 2nd Edition, 2012. 2. George Athanasopoulos and Rob J. Hyndman, "Forecasting: Principles and Practice".O texts, WWW. otexts.org 3. Hamdy A. Taha, "Operations Research: An Introduction". Pearson; 9 editions September 2010. 		

4. L. R. Folds, "Optimization Techniques: An Introduction". Springer-Verlag New York, 1981
5. Ronald L. Rardin, "Optimization in operations research". Prentice Hall, 1998
6. Spyros Makridakis and Steven C. Wheelwright, "Forecasting: Methods and Applications". Wiley 1997.

Course Outcomes:**Upon the completion of the course the student should be able To**

- C309.1 Identify the types of forecasting techniques.
- C309.2 Perform time series modelling and forecasting
- C309.3 Evaluate the performance of forecasting models
- C309.4 Perform regression analysis using different regression models
- C309.5 Distinguish and Identify a suitable numerical method of optimization
- C309.6 Discuss the concept of advanced optimization techniques using soft computing techniques and apply the m To various problems

PO vs. CO Mapping

CO No	PO _a	PO _b	PO _c	PO _d	PO _e	PO _f	PO _g	PO _h	PO _i	PO _l
C309.1	2				2				2	2
C309.2	3		2			2			2	2
C309.3	3	2	2		2	2				2
C309.4	2	2				2			2	2
C309.5	2	2			2					2
C309.6	2								2	2

1 → Low, 2 → Medium, 3 → High