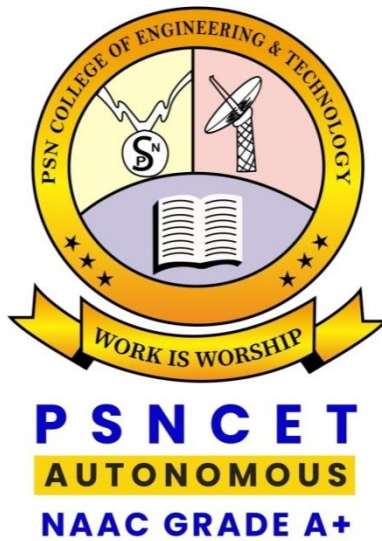


# **PSN College of Engineering and Technology**



**Department of Computer Science and Engineering**

**M.Tech - Information Technology**

R 2022- Curriculum and Syllabus (I to IV Semester)



## PSN COLLEGE OF ENGINEERING AND TECHNOLOGY

(An Autonomous Institution Recognised by AICTE, New Delhi  
and Affiliated to Anna University, Chennai)

Accredited with A+ Grade by NAAC. An ISO 9001:2015 Certified Institution  
Melathediyoor, Tirunelveli – 627 152

### REGULATIONS – R2022 (Full Time)

#### M. Tech - Information Technology

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## **Vision and Mission of the Institute**

### **Vision**

**Emerge as a pioneer institute inculcating engineering education and skills, research, values and ethics.**

### **Mission**

- **To achieve greater heights of excellence in technical knowledge and skill development through innovative teaching and learning practices.**
- **To develop the state of art infrastructure to meet the demands of technological revolution.**
- **To improve and foster research in all dimensions for betterment of society.**
- **To develop individual competencies to enhance innovation, employability and entrepreneurship among students.**
- **To instill higher standards of discipline among students, inculcating ethical and moral values for societal harmony and peace**

## **Vision and Mission of the Department**

### **Vision**

**To emerge as a preeminence program to produce quality Computer Science and Engineering graduates.**

### **Mission**

- **To enhance professional and entrepreneurial skills through industry institute interaction to enable them in getting better placement**
- **To promote research and continuing education**
- **To train the students according to their discipline to meet dynamic needs of the society**

### Program Outcomes (POs)

PO's No	KNOWLEDGE	STATEMENTS
1	Engineering Knowledge:	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2	Problem Analysis:	Identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3	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.
4	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.
5	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 UN 2 of the limitations.
6	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.
7	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.
8	Ethics:	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9	Individual and Team Work:	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

<b>10</b>	Communication:	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
<b>11</b>	Project Management and Finance:	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
<b>12</b>	Life-long Learning:	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

#### **Program Educational Objectives (PEOs)**

<b>S.No</b>	<b>Topic</b>	<b>PEOs</b>
PEO1	<b>Fundamental Knowledge</b>	Graduates will be able to perform in technical and managerial roles ranging from design, development and problem solving to suit to the industrial needs
PEO2	<b>Career Development</b>	Graduates will be able to successfully pursue higher education and also Graduates will have the ability to adapt, contribute and innovate new technologies in different domains of Computer Science and Engineering
PEO3	<b>Social Identity</b>	Graduates will be ethically and socially responsible engineers in Computer Science and Engineering disciplines

**Program Specific Outcomes (PSOs)**

**Graduating student shall be able to:**

<b>PSO1</b>	Proficient and Innovative with a strong cognizance in the IOT, through the application of acquired knowledge and skills.
<b>PSO2</b>	Design and Implement IOT based solutions for improving operational efficiency by investigating existing industrial environment.

PSN COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)

Department of Computer Science and Engineering

Distribution of Courses - M.Tech IT (R22)

Sl. No	Course code	Course Name	Classification	L	T	P	C
<b>SEMESTER I</b>							
1	CS624001	Applied Mathematics	PC	3	1	0	4
2	IT626001	Advanced Operating Systems	PC	3	0	0	3
3	CS624003	Advanced Data Structures and Algorithms	PC	3	0	0	3
4	CS624004	Cryptography and Hashing	PC	3	0	0	3
5		Programme Elective -I	PE	3	0	0	3
6	AP620004	Research Methodology	IC	3	0	0	3
7	CS624501	Technical Seminar-I	EEC	2	0	0	1
8	CS624101	Data Structures Laboratory	PC	0	0	4	2
9		English for Manuscript Writing	IM	2	0	0	0
<b>SEMESTER II</b>							
10	IT626002	Big Data Analytics Tools and Techniques	PC	3	0	0	3
11	CS624005	Digital Image Processing Tools and Techniques	PC	3	0	0	3
12	CS624007	Cloud Computing Technologies	PC	3	0	0	3
13	CS624008	Internet Security	PC	3	0	0	3
14		Programme Elective -II	PE	3	0	0	3
15		Programme Elective -III	PE	3	0	0	3
16	CS624102	Image Processing Laboratory	PC	0	0	4	2
17		Literature reading skills	IM	2	0	0	0
<b>SEMESTER III</b>							
18		Programme Elective-IV	PE	3	0	0	3
19		Programme Elective-V	PE	3	0	0	3
20		Institute Elective	IE	3	0	0	3
21	CS624301	Project Phase - I	EEC	0	0	8	8
<b>SEMESTER IV</b>							
22	CS624302	Project Phase - II & Journal Publication	EEC	0	0	12	12
23	CS624502	Technical Seminar-II	EEC	2	0	0	1

Sl. No	Subject Code	Subject Name	L	T	P	C	Total Periods
<b>Programme Elective -I [Sem-I]</b>							
1	CS624201	Advanced Database Technologies	3	0	0	3	45
2	IT626201	Web Technology	3	0	0	3	45
3	IT626202	Unix Internals	3	0	0	3	45
4	IT626203	Wireless Sensor Networks	3	0	0	3	45
5	CS624203	Artificial Intelligence	3	0	0	3	45

**Programme Elective -II [Sem-II]**

1	CS624206	Internet of Things	3	0	0	3	45
2	IT626204	Deep Learning	3	0	0	3	45
3	IT626205	Network Security	3	0	0	3	45
4	CS624209	Software Reliability and Metrics	3	0	0	3	45
5	IT626205	Human Computer Interaction Techniques	3	0	0	3	45

**Programme Elective -III [Sem-II]**

1	IT626207	Advanced Computer Graphics and Animations	3	0	0	3	45
2	CS624211	Software Quality Assurance and Testing	3	0	0	3	45
3	CS624212	Cognitive Computing	3	0	0	3	45
4	CS624213	Social Network Analysis	3	0	0	3	45
5	CS624215	Blockchain Technologies	3	0	0	3	45

**Programme Elective -IV [Sem-III]**

1	IT626208	Pattern Recognition	3	0	0	3	45
2	IT626209	Parallel Computing	3	0	0	3	45
3	IT626210	Mobile Application Development	3	0	0	3	45
4	IT626211	Virtual and Augment Reality	3	0	0	3	45
5	IT626212	Multimedia Databases	3	0	0	3	45

**Programme Elective -V [Sem-III]**

1	CS624221	Multimedia and Compression Techniques	3	0	0	3	45
2	IT626213	Remote Sensing	3	0	0	3	45
3	IT626214	Grid Computing	3	0	0	3	45
4	IT626215	Web Mining	3	0	0	3	45
5	IT626216	Software Quality Assurance	3	0	0	3	45



### Institute Elective

<b>Sl. No</b>	<b>Subject Code</b>	<b>Subject Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>Total Periods</b>
<b>1</b>	<b>IT626901</b>	Modern Sensor Technology	3	0	0	3	45
<b>2</b>	<b>IT626902</b>	Decision Support and Intelligent Systems	3	0	0	3	45

# **I SEMESTER**

**CS624001/ Applied mathematics**

<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>Unit I – PROBABILITY AND RANDOM VARIABLES</b>					<b>9</b>
Probability - Baye’s Theorem and Applications - Discrete and Continuous Random Variables - Discrete Probability Distributions - Binomial, Poisson and Geometric - Continuous Probability Distributions - Uniform, Exponential and Normal					
<b>Unit II – QUEUING MODELS</b>					<b>9</b>
Poisson Process - Markovian Queues - Single and Multi-Server Models - Little’s Formula - Machine Interference Model - Self Service Queue -Non- Markovian Queues - PollaczekKhintchine Formula					
<b>Unit III – SIMULATION</b>					<b>9</b>
Discrete Even Simulation - Monte - Carlo Simulation - Stochastic Simulation – Applications to Queuing systems					
<b>Unit IV – LINEAR PROGRAMMING</b>					<b>9</b>
Formulation - Graphical Solution - Simplex Method - Two Phase Method - Transportation and Assignment Problems					
<b>Unit V- NON-LINEAR PROGRAMMING</b>					<b>9</b>
Lagrange Multipliers - Equality Constraints - Inequality Constraints - Kuhn - Tucker conditions - Quadratic Programming.					
<b>TOTAL: 45 PERIODS</b>					

<b>IT626001: Advanced Operating Systems</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To learn the fundamentals of Operating Systems..</li> <li>• To gain knowledge on Distributed operating system concepts.</li> <li>• To gain insight on to the distributed resource management components.</li> <li>• To know the components and management aspects of Real time, Mobile operating systems</li> <li>• To learn about the Linux system and Management.</li> </ul>					
<b>Unit 1 FUNDAMENTALS OF OPERATING SYSTEMS</b>					
Overview – Synchronization Mechanisms – Processes and Threads - Process Scheduling – Deadlocks: Detection, Prevention and Recovery – Models of Resources – Memory Management Techniques					<b>9</b>
<b>Unit 2 DISTRIBUTED OPERATING SYSTEMS</b>					
Issues in Distributed Operating System – Architecture – Communication Primitives – Lamport’s Logical clocks – Causal Ordering of Messages – Distributed Mutual Exclusion Algorithms – Centralized and Distributed Deadlock Detection Algorithms – Agreement Protocols					<b>9</b>
<b>Unit 3 DISTRIBUTED RESOURCE MANAGEMENT</b>					
Distributed File Systems – Design Issues - Distributed Shared Memory – Algorithms for Implementing Distributed Shared memory–Issues in Load Distributing – Scheduling Algorithms – Synchronous and Asynchronous Check Pointing and Recovery – Fault Tolerance – Two-Phase Commit Protocol – Nonblocking Commit Protocol – Security and Protection					<b>9</b>
<b>Unit 4 REAL TIME AND MOBILE OPERATING SYSTEMS</b>					
Basic Model of Real Time Systems - Characteristics- Applications of Real Time Systems – Real Time Task Scheduling - Handling Resource Sharing - Mobile Operating Systems –Micro Kernel Design - Client Server Resource Access – Processes and Threads - Memory Management - File system					<b>9</b>
<b>Unit 5 LINUX SYSTEM AND MANAGEMENT</b>					
Linux System: Design Principles - Kernel Modules - Process Management Scheduling - Memory Management - Input-Output Management - File System - Interprocess Communication. iOS and Android: Architecture and SDK Framework - Media Layer - Services Layer - Core OS Layer - File System					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : know the basics of operating systems					
CO2 : know the concepts of Distributed operating Systems					
CO3 : Understand the Concept of Distributed Resource management					
CO4 : Learn about the Concept of Real time and mobile operating systems					
CO5 : Understand the concept of Linux and management					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				2									
CO2	3			2										
CO3	2		2											
CO4	2					2								
CO5	2	2												

**REFERENCE BOOKS:**

1. Mukesh Singhal and Niranjana G. Shivaratri, "Advanced Concepts in Operating Systems – Distributed, Database, and Multiprocessor Operating Systems", Tata McGraw-Hill, 2001
2. Abraham Silberschatz; Peter Baer Galvin; Greg Gagne, "Operating System Concepts", Seventh Edition, John Wiley & Sons, 2004
3. Daniel P Bovet and Marco Cesati, "Understanding the Linux kernel", 3rd edition, O'Reilly, 2005

<b>CS624003: Advanced Data structures and Algorithms</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To understand the usage of algorithms in computing</li> <li>To learn and use hierarchical data structures and its operations</li> <li>To learn the usage of graphs and its applications</li> <li>To select and design data structures and algorithms that is appropriate for problems</li> <li>To study about NP Completeness of problems.</li> </ul>					
<b>Unit 1 Algorithm and Analysis of Algorithm</b>					
Algorithms – Algorithms as a problem solving technique – Time and Space complexity of algorithms- Asymptotic analysis-Average and worst-case analysis- Asymptotic notation-Importance of efficient algorithms- Recurrences: The Substitution Method – The Recursion-Tree Method- Data structures and algorithms.					<b>9</b>
<b>Unit 2 Hierarchical Datastructures</b>					
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- Heap – Heap Implementation – Fibonacci Heaps: structure – Mergeable-heap operations- Decreasing a key and deleting a node-Bounding the maximum degree.					<b>9</b>
<b>Unit 3 Graphs</b>					
Elementary Graph Algorithms: Representations of Graphs – Breadth-First Search – Depth-First Search –Strongly Connected Components- Minimum Spanning Trees: Kruskal and Prim- Single-Source Shortest Paths: The Bellman-Ford algorithm – Single-Source Shortest paths in Directed Acyclic Graphs – Dijkstra’s Algorithm; All-Pairs Shortest Paths: The Floyd-Warshall Algorithm					<b>9</b>
<b>Unit 4 Algorithm Design Techniques</b>					
Dynamic Programming: Multi-stage graphs – Flow Shop Scheduling; Greedy Algorithm: Tree vertex Splitting – Job sequencing with deadlines; Backtracking: Graph Coloring – Knapsack Problem					<b>9</b>
<b>Unit 5 NP – Complete and NP - Hard</b>					
NP-Completeness: Polynomial Time – Polynomial-Time Verification – NP-Completeness and Reducibility – NP-Completeness Proofs – NP-Complete Problems: Clique Decision Problem – Traveling Salesman Problem.					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Design algorithms for various computing problems and analyze the time and space complexity of algorithms.					
CO2 : Identify and implement tree data structures and apply them to solve problems.					
CO3 : Identify and implement graph data structures and apply them to solve problems.					
CO4 : Ability to understand and design algorithms using appropriate algorithm design techniques for the given problem.					
CO5 : Ability to understand role the NP – Complete and NP – Hard Problems in solving real world problems.					

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	-	-	-	3	-
CO2	3	3	3	3	-	-	-	-	-	-	-	-	2	-
CO3	3	3	3	3	-	-	-	-	-	-	-	-	-	2
CO4	3	3	3	3	-	-	-	-	-	-	-	-	-	1
CO5	3	2	2	2	-	-	-	-	-	-	-	-	-	2

**REFERENCE BOOKS:**

1. S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.
2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.
3. Ellis Horowitz, SartajShani, SanguthevarRajasekaran, "Fundamentals Of Computer Algorithms". India, Misc, 2010.
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd
5. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint, 2006.

<b>CS624004: Cryptography and Hashing</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To introduce the fundamental concepts and techniques in cryptography and network security</li> <li>To illustrate the working principles of various Symmetric Ciphers.</li> <li>To explore knowledge on Asymmetric Ciphers.</li> <li>To study system boot and the Init process.</li> <li>To learn the various Hash function.</li> <li>To realize the Construction.</li> </ul>					
<b>Unit 1 INTRODUCTION</b>					
Computer Security Concepts- OSI Security Architecture- Security Attacks- Security Services- Security Mechanisms-Model for Network Security-Classical Encryption Techniques- Symmetric Cipher Model-Substitution Techniques- Transposition Techniques- Rotor Machines- Stegnography- Basic Concepts in Number Theory and Finite Fields-Divisibility and the Division Algorithm- Euclidean Algorithm- Modular Arithmetic-Groups, Rings, and Fields- Finite Fields of the Form GF(p)					<b>9</b>
<b>Unit 2 MODERN SYMMETRIC CIPHERS</b>					
Block Ciphers and the Data Encryption Standard-Block Cipher Principles-The Data Encryption Standard (DES)- Strength of DES-Differential and Linear Cryptanalysis-Block Cipher Design Principles-Advanced Encryption Standard-Block Cipher Modes of Operation- Stream Ciphers-RC4					<b>9</b>
<b>Unit 3 ASYMMETRIC CIPHERS</b>					
Prime Numbers- Fermat's and Euler's Theorems- Testing for Primality- Chinese Remainder Theorem-Discrete Logarithms- Principles of Public-Key Cryptosystems- RSA Algorithm- Diffie-Hellman Key Exchange- ElGamal Cryptosystem- Elliptic Curve Arithmetic- Elliptic Curve Cryptography					<b>9</b>
<b>Unit 4 HASH FUNCTION</b>					
Block cipher Based hash function - Non-Block cipher Based hash function - Design principles - Methods of Attack on Hash function					<b>9</b>
<b>Unit 5 CONSTRUCTION</b>					
Theoretic Construction - Hard bit and Pseudo random bit generation - strong one-way permutation - UOWHF Construction and PBG -Strong one-way permutation					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Apply essential mathematical concepts to Cryptography and identify the vulnerabilities in Classical cryptosystems					
CO2 : Experiment Symmetric-Key cipher algorithms					
CO3 : Apply Asymmetric-Key Cryptographic techniques					
CO4 : Manipulate the Hash function					
CO5 : Demonstrate cryptographic Hash function to real-time applications					



**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3									3		
CO2	3	3	3		2						3	3	3	
CO3	3	3	2		2						3	3	3	
CO4	3	2	3	2							2	2		2
CO5	3	3	3	2	3						2	2		2

**REFERENCE BOOKS:**

1. William Stallings, "Cryptography and network Security", Pearson, Sixth edition, 2013.
2. Alan G. Konheim, "Computer security & cryptography", John Wiley & Sons, 2007.
3. Josef Pieprzyk Babak Sadeghiyan, "Design of hashing Algorithms", Springer-Verlag 1993
4. Charles P. Pfleeger, Shari Lawrence Pfleeger, "Security in computing", Prentice Hall of India, Third Edition, 2006.
5. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", Pearson, Second edition, 2007
6. Behrouz A.Forouzan, "Cryptography and Network Security", Tata McGraw Hill, 2010.
7. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007

<b>AP620004 -RESEARCH METHODOLOGY</b>					
<b>Course Category: Instiutive core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>		<ul style="list-style-type: none"> <li>• Impart knowledge on basics of research methodology</li> <li>• Explore knowledge in technical writing in an efficient manner</li> <li>• Understand research problem formulation and analyses the research related information</li> <li>• Understand the importance of IPR</li> <li>• Apply the knowledge of IPR in various research projects</li> </ul>			
<b>UNIT - I RESEARCH PROCESS</b>					
Research ethics - Research process: characteristics and requirements, Types of research, Research process: eight step model - formulating research problem, conceptualizing research design, constructing instrument for data collection, Selecting a sample, writing a research proposal, collecting data, processing data, writing research report.				<b>9</b>	
<b>UNIT - II RESEARCH WRITING</b>					
Effective literature studies approaches - technical document structuring - how to write report and research paper - format of research proposal - developing research proposal - presentation and assessment by a review committee.				<b>9</b>	
<b>UNIT - III DESIGN OF EXPERIMENTS</b>					
Strategy of Experimentation - Typical applications of experimental design - Guidelines for designing experiments - Basic statistical concepts - Statistical concepts in experimentation - Regression approach to analysis of variance.				<b>9</b>	
<b>UNIT - IV INTELLECTUAL PROPERTY</b>					
Patents, Industrial designs and IC layout Designs, Trade Marks and Copyright, Geographical Indications, IPR management: 5Cs model of managing IP, Emerging issues in IPR.				<b>9</b>	
<b>UNIT - V ROADMAP FOR PATENT CREATION</b>					
Types of patent - Parts of a patent document - Terminologies and codes used in patent document - Patent searching and analysis – Indicators for patentability - IP identification tool – public patent data base – Transfer and infringement of patent rights – Patent commercialization.				<b>9</b>	
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Understand that today’s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.					
CO2 : Correlate the results of any research article with other published results. Write are view article in the field of engineering					
CO3 : Understand research problem formulation & Analyze research related information and Follow research ethics					
CO4 : Appreciate the importance of IPR and protect their intellectual property.					
CO5 : Understand that PR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	1	2	3	1	2		2		1	2		
CO2	2	3	1	3	2	2	2	1			2	2		
CO3	2	2	2	3	3	1	2			1		2		
CO4	3	3	1	1	3	3	2	1	2			2		
CO5	1	1	1	3	3	2	1		1		3	2		

**REFERENCE BOOKS:**

1. Ranjit Kumar, Research Methodology- A step by step guide for beginners, Pearson Education, Australia, 2005.
2. Ann M. Korner, Guide to Publishing a Scientific paper, Bioscript Press 2004.
3. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008
4. Kothari, C. R. Research Methodology - Methods and Techniques, New Age International publishers, New Delhi, 2004.
5. Robert P. Merges, Peter S. Menell and Mark A. Lemley, "Intellectual Property in New Technological Age", Aspen Publishers, 2016

<b>CS624101: DATA STRUCTURES LABORATORY</b>														
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>									
		<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>									
<b>COURSE OBJECTIVES:</b>		<ul style="list-style-type: none"> <li>To acquire the knowledge of using advanced tree structures.</li> <li>To learn the usage of heap structures.</li> <li>To understand the usage of graph structures and spanning trees.</li> <li>To learn about Huffman Coding</li> </ul>												
<b>LIST OF EXPERIMENTS:</b>		<ol style="list-style-type: none"> <li>Implementation of Merge Sort and Quick Sort-Analysis</li> <li>Implementation of a Binary Search Tree</li> <li>Red-Black Tree Implementation</li> <li>Heap Implementation</li> <li>Fibonacci Heap Implementation</li> <li>Graph Traversals</li> <li>Spanning Tree Implementation</li> <li>Shortest Path Algorithms (Dijkstra's algorithm, Bellman Ford Algorithm)</li> <li>Implementation of Matrix Chain Multiplication</li> <li>Activity Selection and Huffman Coding Implementation</li> </ol>												
<b>TOTAL: 30 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1 : Design and implement basic data structures.														
CO2 : Implement advanced data structures extensively														
CO3 : Design algorithms using graph structures														
CO4 : Design and develop efficient algorithms with minimum complexity using design techniques														
CO5 : Understand and develop Dynamic programming algorithms.														
<b>CO PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	-	-	-	-	-	-	-	-	-	3	-
CO2	3	-	3	-	2	-	-	-	-	-	-	-	3	-
CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	-
CO4	3	3	2	-	-	-	-	-	-	-	-	-	-	2
CO5	2	3	3	-	-	-	-	-	-	-	-	-	-	2
<b>REFERENCE BOOKS:</b>														
1. S.Sridhar, "Design and Analysis of Algorithms", Oxford University Press, 1st Edition, 2014.														
2. Adam Drozdex, "Data Structures and algorithms in C++", Cengage Learning, 4th Edition, 2013.														
3. Ellis Horowitz, SartajShani, SanguthevarRajasekaran, "Fundamentals Of Computer Algorithms". India, Misc, 2010.														
4. T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, "Introduction to algorithms", Second Edition, Prentice Hall of India Ltd														
5. Mark Allen Weiss, "Data Structures and Algorithms in C++", Pearson Education, 3rd Edition, 2009														
6. Alfred V. Aho, John E. Hopcroft, Jeffrey D. Ullman, "Data Structures and Algorithms", Pearson Education, Reprint, 2006														

# **II SEMESTER**

<b>IT626002: Big Data Analytics Tools and Techniques</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To gain knowledge about the competitive advantages of big data analytics.</li> <li>To understand about the big data frameworks.</li> <li>To understand about the features of Data Analysis.</li> <li>To learn about the Stream Computing.</li> <li>To gain knowledge on Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics</li> </ul>					
<b>Unit I Introduction to Big Data</b>					
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					<b>9</b>
<b>Unit 2 Hadoop Frame Work</b>					
Distributed File Systems - Large-Scale File System Organization – HDFS concepts - MapReduce Execution, Algorithms using MapReduce, Matrix-Vector Multiplication – Hadoop YARN					<b>9</b>
<b>Unit 3 Data Analysis</b>					
Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination					<b>9</b>
<b>Unit 4 Mining Data Streams</b>					
Statistical Methods: Regression modelling, 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					<b>9</b>
<b>Unit 5 Big Data Frameworks</b>					
Introduction to NoSQL – Aggregate Data Models – Hbase: Data Model and Implementations – Hbase 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 – HiveQL Data Definition – HiveQL Data Manipulation – HiveQL Queries					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : To know, how to leverage the insights from big data analytics					
CO2 : Know the concepts of Hadoop frame work					
CO3 : Know the concepts of Data Analysis					
CO4 : Analyze data by utilizing various statistical and data mining approaches					
CO5 : Understand the various NoSql alternative database models					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2										1	
CO2	2		2	2										1
CO3	3	2											1	
CO4	3		2	2										
CO5					2									

**REFERENCE BOOKS:**

David Loshin, "Big Data Analytics: From Strategic Planning to Enterprise Integration with Tools, Techniques, NoSQL, and Graph", 2013

Michael Berthold, David J. Hand, —Intelligent Data Analysis, Springer, Second Edition, 2007

Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013

P. J. Sadalage and M. Fowler, "NoSQL Distilled: A Brief Guide to the Emerging World of Polyglot Persistence", Addison-Wesley Professional, 2012

<b>CS624005: Digital Image Processing Tools and Techniques</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To provide the basic knowledge of Digital Image Processing.</li> <li>To Know the various image enhancement techniques.</li> <li>To understand the various concepts of image segmentation.</li> <li>To Learn about compression techniques.</li> <li>To extract features for image analysis and also illustrate 3D image visualization</li> </ul>					
<b>Unit 1 INTRODUCTION TO DIGITAL IMAGE PROCESSING</b>					
Image Representation and Image Processing Paradigm - Elements of digital image processing. Sampling and quantization-Relationships between pixels- Connectivity, Distance Measures between pixels - Color image (overview, various color models)- Various image formats bmp, jpeg, tiff, png, gif.					<b>9</b>
<b>Unit 2 IMAGE ENHANCEMENT</b>					
Enhancement by point processing, Sample intensity transformation, Histogram processing, Image subtraction, Image averaging, Spatial filtering- Smoothing Spatial filters, Sharpening Spatial filters, Frequency domain- Fourier Transform, Low-Pass, HighPass, Laplacian, Homomorphic filtering.					<b>9</b>
<b>Unit 3 IMAGE SEGMENTATION</b>					
Edge detection, Thresholding, Region growing, Fuzzy clustering, Water shed algorithm, Active contour models, Texture feature based segmentation, Graph based segmentation, Wavelet based Segmentation-Applications of image segmentation. Region oriented segmentation- Histogram based segmentation.					<b>9</b>
<b>Unit 4 IMAGE COMPRESSION</b>					
Lossless compression versus lossy compression-Measures of the compression efficiency- Huf- mann coding-Bitplane coding-Shift codes-Block Truncation coding-Arithmetic coding-Predictive coding techniques-Lossy compression algorithm using the 2-D. DCT transform-The JPEG 2000 standard Baseline lossy JPEG, based on DWT					<b>9</b>
<b>Unit 5 FEATURE EXTRACTION AND 3D IMAGE VISUALIZATION</b>					
Feature extraction: Histogram based features - Intensity features-Color, Shape features-Contour extraction and representation-Homogenous region extraction and representation. Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, The use of color, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiple connected surfaces, Image processing in 3D, Measurements on 3D images					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Understand the basic Concepts of Digital Image Processing and its equivalent open source tools					
CO2 : Apply different Algorithm by utilizing Enhancement Techniques					
CO3 : Learn and apply different Segmentation Techniques in an Image Processing					
CO4 : Explore the possibility of applying various Compression Techniques in an Image processing applications					
CO5 : Analyze different Feature extraction approaches to image processing applications					



**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				2							2	2	1
CO2	3	2			2						1	2	2	2
CO3	2	2	2		2							1	2	2
CO4	2		2		1						2	2	1	2
CO5	2				2						1	2	2	1

**REFERENCE BOOKS:**

1. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Third Ed., PrenticeHall, 2008
2. William K. Pratt, Digital Image Processing, John Wiley, 4th Edition, 2007
3. Anil K. Jain, Fundamentals of Digital Image Processing, Prentice Hall of India, 1997
4. Sonka, Fitzpatrick, Medical Image Processing and Analysis, 1st Edition, SPIE,2000

<b>CS624007: Cloud Computing Technologies</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To understand the concept of cloud and utility computing.</li> <li>• To understand the various issues in cloud computing.</li> <li>• To familiarize themselves with the lead players in cloud.</li> <li>• To appreciate the emergence of cloud as the next generation computing paradigm.</li> <li>• To be able to set up a private cloud.</li> </ul>					
<b>Unit 1 INTRODUCTION</b>					
Introduction - Historical Development - Cloud Computing Architecture – The Cloud Reference Model – Cloud Characteristics – Cloud Deployment Models: Public, Private, Community, and Hybrid Clouds - Cloud Delivery Models: IaaS, PaaS, SaaS – Open Source Private Cloud Software: Eucalyptus, Open Nebula, Open Stack					<b>9</b>
<b>Unit 2 VIRTUALIZATION</b>					
Data Center Technology - Virtualization - Characteristics of Virtualized Environments - Taxonomy of Virtualization Techniques – Virtualization and Cloud Computing – Pros and Cons of Virtualization - Implementation Levels of Virtualization - Tools and Mechanisms: Xen, VMWare, Microsoft Hyper-V					<b>9</b>
<b>Unit 3 CLOUD COMPUTING MECHANISM</b>					
Cloud Infrastructure Mechanism: Cloud Storage, Cloud Usage Monitor, Resource Replication – Specialized Cloud Mechanism: Load Balancer, SLA Monitor, Pay-per-use Monitor, Audit Monitor, Failover System, Hypervisor, Resource Cluster, Multi Device Broker, State Management Database – Cloud Management Mechanism: Remote Administration System, Resource Management System, SLA Management System, Billing Management System					<b>9</b>
<b>Unit 4 HADOOP AND MAP REDUCE</b>					
Apache Hadoop – Hadoop Map Reduce – Hadoop Distributed File System- Hadoop I/O Developing a Map Reduce Application - Map Reduce Types and Formats - Map Reduce Features– Hadoop Cluster Setup – Administering Hadoop					<b>9</b>
<b>Unit 5 SECURITY IN THE CLOUD</b>					
Basic Terms and Concepts – Threat Agents – Cloud Security Threats – Cloud Security Mechanism: Encryption, Hashing, Digital Signature, Public Key Infrastructure, Identity and Access Management, Single Sign-on, Cloud Based Security Groups, Hardened Virtual Server Images					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Articulate the main concepts, key technologies, strengths and limitations of cloud computing					
CO2 : Identify the architecture, infrastructure and delivery models of cloud computing					
CO3 : Explain the core issues of cloud computing such as security, privacy and interoperability					
CO4 : Choose the appropriate technologies, algorithms and approaches for the related issues					
CO5 : Understanding the concepts of Big data tool and its analysis techniques					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO2	-	-	-	2	-	-	-	-	-	2	-	-	-	2
CO3	-	-	3	-	-	-	-	-	-	2	-	-	-	2
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	2	-	-	-	-	-	-	2	-	2

**REFERENCE BOOKS:**

1. Thomas Erl, Zaigham Mahood, Ricardo Puttini, "Cloud Computing, Concept, Technology and Architecture", Prentice Hall, 2013
2. Toby Velte, Anthony Velte, Robert C. Elsenpeter, "Cloud Computing, A Practical Approach", Tata McGraw-Hill Edition, 2010
3. Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi, "Mastering Cloud Computing", Tata McGraw-Hill, 2013

<b>CS624008: Internet Security</b>					
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To study the fundamental concepts of classical encryption techniques and Crypt Analysis.</li> <li>• To understand the principles of secret keys management.</li> <li>• To acquire the concepts of IP Security and its applications</li> <li>• To study the concepts of Transport layer security and its applications</li> <li>• To learn the working principle of Email and public key distribution</li> </ul>					
<b>Unit 1 INTRODUCTION AND BASIC ENCRYPTION</b>					
Introduction – Essentials of Cryptography, Essentials of Networking and Internet, Security Objectives, Communication Security, Legal restrictions, Basics of Encryption – Building Blocks of Encryption, Cryptanalysis and Modern Codes, Brute Force cracking of Secret Keys, Choosing Cryptography Algorithms					<b>9</b>
<b>Unit 2 LINK ENCRYPTION AND SECURE KEY MANAGEMENT</b>					
Link Encryption – In-line Encryptor, Point to Point Encryption, IP Routed Configuration, Managing Secret Keys – Issues in Secret Key Management, Technology - Random Key Generation, Random Seeding, Pseudorandom Number Generators, Manual Key Distribution, Automatic Rekeying, Key Distribution Centres, Maintaining Keys and System Security					<b>9</b>
<b>Unit 3 IP LAYER SECURITY AND APPLICATIONS</b>					
Basic Issues in IP Security (IPSEC), Cryptographic Checksums, IP Security Protocol, IPSEC key management, TCP/IP Network Security Protocols, Virtual Private Network (VPN) – Issues in VPN, IPSEC proxy cryptography, IPSEC encrypting Router, Site to Site Encryption, Remote Access with IPSEC – problems in IPSEC clients, IPSEC Client, Client to Server site access					<b>9</b>
<b>Unit 4 TRANSPORT LAYER SECURITY AND APPLICATIONS</b>					
Public Key Cryptography, RSA Encryption, Key Exchange with RSA, Secure Socket Layer (SSL), World Wide Web Transaction Security – Issues in Internet Transaction Security, Transactions on World Wide Web, Security Alternatives for Web Forms, Web Browser with SSL, Web Server with SSL					<b>9</b>
<b>Unit 5 SECURE E-MAIL AND PUBLIC KEY CERTIFICATES</b>					
Secure Email - Email Security Issues, Basics of Internet E-Mail, Offline Message Keying, Digital Signature, Secure Email Client, Public Key Certificates – Distributing Public Keys, Public Key Certificates, Certificate Distribution, Centralized Certification Authority, Hierarchical Certification Authority, Pretty Good Privacy (PGP)					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Interpret basic building blocks of encryption for cryptanalysis					
CO2 : Identify suitable key generation technique for secret key management					
CO3 : Apply IP security in VPN and Remote Access					
CO4 : Apply SSL in World wide web transactions					
CO5 : Discover various public key and certificate distribution strategies and its use in PGP					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3									3		
CO2	3	3	3		2						3	3	3	
CO3	3	3	2		2						3	3	3	
CO4	3	2	3	2							2	2		2
CO5	3	3		2								2		2

**REFERENCE BOOKS:**

1. Richard E.Smith, Internet Cryptography, 6th Edition, Pearson, 2011
2. Tim Speed, Juanita Ellis, "Internet Security", Elsevier, 2006
3. Uyles Black, "Internet Security Protocols – Protecting IP Traffic", Pearson Education, 2001
4. Wade Trappe, Lawrence C Washington, "Introduction to Cryptography with coding theory", 2nd edition, Pearson, 2007
5. William Stallings, Cryptography and Network Security, 6th Edition, Pearson Education, March 2013
6. Bruce Schneier and Neils Ferguson, —Practical Cryptography, First Edition, WileyDreamtech India Pvt Ltd, 2003
7. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, Second Edition, 2007
8. Douglas R Simson —Cryptography –Theory and practice, First Edition, CRC Press,1995

<b>CS624102: IMAGE PROCESSING LABORATORY</b>														
<b>Course Category: Programme Core</b>	<b>Course Type: Theory</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>							
				<b>0</b>	<b>0</b>	<b>4</b>	<b>2</b>							
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>• To learn Image Processing Techniques</li> <li>• To display various Images in Image Processing</li> <li>• To implement Various Segmentation Techniques in Image Processing</li> <li>• To implement Image restoring techniques .</li> <li>• To implement slicing technique for image enhancement</li> </ul>														
<b>LIST OF EXPERIMENTS</b>														
<ol style="list-style-type: none"> <li>1. Display of Grayscale Images Image, Negative of an Image (Binary &amp; Gray Scale)</li> <li>2. Implementation of Relationships between Pixels.</li> <li>3. Implementation of Transformations of an Image .</li> <li>4. Implementation of image restoring techniques</li> <li>5. Implementation of Image Intensity slicing technique for image enhancement</li> <li>6. Implementation of Canny edge detection Algorithm</li> <li>7. Implement the Algorithm for Edge detection using Operators</li> <li>8. Implementation of Segmentation using watershed transform.</li> <li>9. Implementation of Histogram Equalization Algorithm.</li> <li>10. Implementation of Non-linear Filtering Techniques.</li> <li>11. Implement the Algorithm for Edge detection using Operators.</li> <li>12. Implementation of Filtering in frequency domain</li> </ol>														
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1 : learn Image Processing Techniques														
CO2 : implement Various Segmentation Techniques in Image Processing														
CO3 : implement slicing technique for image enhancement														
<b>CO PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2						2		2	1
CO2	3		2									2		2
CO3	2	2			1							1	2	

**PROGRAMME  
ELECTIVE -I [SEM-I]**

<b>CS624201: Advanced Database Technologies</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To know the fundamental Concepts of Database Management.</li> <li>• To define a good database design</li> <li>• To define query processing using views</li> <li>• To explain the importance of security in statistical databases</li> <li>• To state the principle of design of distributed database management system</li> </ul>					
<b>Unit 1 Overview</b>					
Overview of a Database Management Systems – Evolution of Database Management Systems – Basics of the Relational Model – Design of Relational Database Schemas – High level Database Models: Design principles – Algebraic and Logical Query Languages – Database Language SQL – SQL in a Server Environment – Semi-structured Data Model – Data Mining – Information Integration					<b>9</b>
<b>Unit 2 Query Processing and Evaluation</b>					
Query Processing: An Introduction: optimization – measure of query cost – select operation – sorting – Join operation: Nested loop – Block nested loop – Indexed nested loop – merge join – hash join – complex join – other operations – Representation and Evaluation of Query Expression – Creation of Query Evaluation Plans – View and Query Processing					<b>9</b>
<b>Unit 3 Relational Database Design</b>					
Overview – Basics of the Relational Model – Features of Good Database Design – Enhanced ER Tools – Functional Dependency: Theory and Normalization – Multivalued Dependency – Fourth Normal Forms – Join Dependency – Fifth Normal Form – Inclusion Dependency – Template Dependency - Domain Key Normal Form – Modeling Temporal Data					<b>9</b>
<b>Unit 4 Transaction Management and Recovery</b>					
Introduction – Transaction Processing – Enhanced Lock Based Protocol – Timestamp Based Protocol: Multiple Granularity – Multi Version Schemas: Multi Version Timestamp Ordering – Multi Version Two Phase Locking – Weak Levels of Consistency – Concurrency in Index Structures – Failure Classification – Recovery Algorithms – Buffer Management – Advanced Recovery Techniques – Remote Backup Systems					<b>9</b>
<b>Unit 5 Database Security and Authorization</b>					
Introduction – Database Security: Scenario – Levels of Database Security: Server Security – Database Connections – Table Access Control – Restricting Database Access – Access Control: Granting permissions – Removing permissions – Statistical Database Security – Multilevel Security – Audit trails in Database – Vendor Specific E-security					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Understand the fundamental Concepts of Database					
CO2 : Learn about Query Processing and Evaluation					
CO3 : Know & Discuss Relational Database Design					



CO4 : Understand the concept of Transaction and Analyze the Algorithms to give Recovery Techniques

CO5 : Understand the High Levels of Data Security & Access Control

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3				2									2
CO2		2		3					2		2		1	
CO3	3	2	2		3						1		2	
CO4	2										2			1
CO5	1				2				3		3		2	

**REFERENCE BOOKS:**

1. Hector-Garcia Molina, Jeffery D.Ullman, Jenifer Wisdom, "Database System – The Complete Book" Stanford University, Pearson Prentice Hill, 2<sup>nd</sup> Edition
2. Dr.Radyanbi Tibor "Advanced Database Management Systems" Tartalom Publication
3. Silberschatz, Korth and Sudarshan "Database System Concepts" 7<sup>th</sup> Edition
4. Data base Management Systems, Raghurama Krishnan, Johannes Gehrke, TATA
5. McGrawHill 3rd Edition
6. Jef Van Loon "Database Security Concepts and Challenges" Pearson, 5<sup>th</sup> Edition

<b>IT626201: WEB TECHNOLOGY</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• Understand the fundamentals of object-oriented programming in Java</li> <li>• Understand the appropriate roles of subtyping and inheritance, and use them effectively.</li> <li>• Implement polymorphic code and handle runtime errors using exception handling</li> <li>• Implement polymorphic code and handle runtime errors using exception handling</li> <li>• Create user interface applications using GUI components and to understand the event handling principles.</li> </ul>					
<b>UNIT I INTRODUCTION TO INTERNET</b>					
<p>Overview: Evolution of the Internet, How Internet Works- Services offered on the Internet: E-mail, Network News, Telnet, FTP, IRC. Internet Access Method: Dial-up connection, Leased line, ISDN. Internet Services Providers (ISP): Architecture, Connection through an ISP Server, World Wide Web Browsing: URL, Homepage, document management, cookies, plug-in, online &amp; offline Browsing. WWW: History of WWW, different web generations, W3C. Search Engines: Technology Overview. Popular search engines, how to register a website on search engines</p>					<b>9</b>
<b>UNIT II MARK-UP LANGUAGES</b>					
<p>HTML&amp; XHTML: Basic layout of HTML, Head Section: title, base, link, meta. Body Section: Text formatting and alignment, fonts, colors, ordered and unordered lists, links, images, sounds, video, background, tables, forms, frames. Introduction to XHTML, DHTML: Cascading style sheet, inline styles, embedded style, linking external style sheets, positioning elements, user style sheets, document object model. XML: Structuring data, XML namespaces, DTD and schemas, XML variables, DOM methods, simple API for XML, web services, application of XML</p>					<b>9</b>
<b>UNIT III SCRIPTING LANGUAGES</b>					
<p>Java Scripts: Introduction to scripting, user input/output, memory concepts, arithmetic, decision making, control statement, functions, arrays, objects. VBScripts: Operators, data types and control statements, functions, arrays, string manipulation, classes &amp; objects. Active Server Pages(ASP): How ASP works, ASP objects, file system, objects, Active Xcomponents .NET overview, XML: Case study</p>					<b>9</b>
<b>UNIT IV WEB DEVELOPMENT USING JAVA</b>					
<p>Overview of Java, Use of Java for web development. Java Applets: Applet architecture, applet class, life-cycle of applets, display methods requesting repainting, using the status window, HTML applet tag, passing parameter to applets. Servlets: Servlet architecture and life-cycle, handling HTTP post &amp;get request, multi-tier application using JDBC from servlet</p>					<b>9</b>
<b>UNIT V JSP AND WEB SERVERS</b>					
<p>JSP: Architecture, standard actions, JSP with JDBC. J2EE &amp; EJB: Component architecture, introducing enterprise Java Beans, J2EE Technologies, foundation for EJB, EJB objects and Bean Instances. Web Servers (IIS/ PWS &amp;Apache): HTTP request types, system architecture, client-side scripting, accessing web servers requesting documents</p>					<b>9</b>

**TOTAL: 45 PERIODS**

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

CO1 : Understand the fundamentals of object-oriented programming in Java

CO2 : Understand the appropriate roles of subtyping and inheritance, and use them effectively

CO3 : Implement polymorphic code and handle runtime errors using exception handling

CO4 : To identify the generic classes and methods to implement an application  
Use streams to store and retrieve data from database/files

CO5 : Create user-interface applications using GUI components and to understand the event handling principles

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	2							2	1	
CO2	3	2	2	1	2							2	1	
CO3	3	2	2	2	2							2		1
CO4	3	2	2	1	2							2		1
CO5	3	2	2	2	2							2		1

**REFERENCE BOOKS:**

1. ATimothy Budd, “An Introduction to Object-Oriented Programming”, Third Edition, PearsonEducation,2008
2. Paul Deitel and Harvey Deitel, “Java How to Program (Early Objects)”, Tenth Edition,PearsonPrenticeHall2014
3. Jesse Feiler, Managing the Web Based Enterprise[Morgan Kaufmann]
4. Chuck Musciano & Bill Kennedy, HTML & XHTML [SPD]
5. D. Hunter, et. Al. Beginning XML [WROX]
6. R. Kalakota, A.B. Whinston, Frontier of Electronic Commerce [Addition- Wesley]

<b>IT626202: Unix Internals</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To introduce the architecture of the Unix Operating System</li> <li>• To understand the buffer structure, the inodes representation and super block.</li> <li>• To cover various system calls and its usage.</li> <li>• To study system boot and the Init process.</li> <li>• To introduce process states, signals and process scheduling.</li> <li>• To understand memory management and I/O sub system</li> </ul>					
<b>Unit 1 GENERAL OVERVIEW OF THE SYSTEM</b>					
History – System structure – User perspective – Operating system services – Assumptions about hardware – Introduction to the kernel – Architecture of the UNIX operating system – Introduction to system concepts – Kernel data structures – System administration					<b>9</b>
<b>Unit 2 BUFFER CACHE AND FILE SUBSYSTEM</b>					
Buffer Headers – Structure of the Buffer Pool –Scenarios for Retrieval of Buffer- Advantages and Disadvantages of the Buffer Cache – Internal Representation of Files – Inodes – Structure of a Regular File – Directories – Conversion of a Path Name to an Inode – Super Block –inode assignment to a New File-Allocation of Disk Blocks					<b>9</b>
<b>Unit 3 SYSTEM CALLS FOR THE FILE SYSTEM</b>					
Open – Read – Write – File and record locking - Adjusting the position of file I/O – Lseek – Close – File creation - Creation of special files -Changing directory - root – owner - mode –stat and fstat – Pipes – Dup – Mounting and unmounting file systems – link – unlink					<b>9</b>
<b>Unit 4 PROCESSES</b>					
Process states and transitions - Layout of system memory - The context of a process - Saving the context of a process - Manipulation of the process address space – sleep - Process Control - Process creation – Signals - Process termination – Awaiting Process termination – Invoking other programs – user id of a process – Changing the size of a process					<b>9</b>
<b>Unit 5 PROCESS SCHEDULING AND MEMORY MANAGEMENT POLICIES</b>					
Process scheduling – Memory management policies – Swapping –Demand Paging- A hybrid system with swapping and demand paging – The I/O subsystem – Driver interfaces – Disk Drivers – Terminal drivers					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Apply the operating system services for UNIX architecture					
CO2 : Identify the appropriate inode, buffer and super block for UNIX file system					
CO3 : Implement various system calls for file system					
CO4 : Implement various system calls for process management					
CO5 : Apply scheduling and memory management strategies for processes					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2									3		
CO2	3	2										3	1	
CO3	3	2	2		2							2	1	
CO4	3	2	2		2							2		1
CO5	3	3										2		1

**REFERENCE BOOKS:**

1. Maurice J. Bach, "The Design of the Unix Operating System", Fourth Edition, Pearson Education, 2015
2. Uresh Vahalia, "Unix Internals: The New Frontiers", Pearson Education, 2008
3. S. J. Leffler, M. K. Mckusick, M. J. .Karels and J. S. Quarterman., "The Design AndImplementation of the 4.3 BSD Unix Operating System", Addison Wesley, 1998
4. Prabhat K. Andleigh, " Unix System Architecture" Prentice Hall, 1990

<b>IT626203: Wireless Sensor Networks</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To be aware of the Challenges and architecture of Wireless Sensor Networks.</li> <li>To get familiarized with different communication protocols and network components in WSN</li> <li>To provide up-to-date knowledge of wideband wireless communication techniques</li> </ul>					
<b>Unit 1 OVERVIEW OF WIRELESS SENSOR NETWORKS</b>					
Definition, advantages, Applications with examples – Types of applications – Challenges for Wireless sensor networks – Characteristic requirements – required mechanisms – Comparison of Mobile ad hoc networks and wireless sensor networks					<b>9</b>
<b>Unit 2 WIRELESS SENSOR NETWORK ARCHITECTURES</b>					
Single–Node Architecture – Hardware Components – Energy Consumption of Sensor Nodes – Operating Systems and Execution Environments – Network Architecture – Sensor Network Scenarios – Optimization Goals and Figures of Merit – Design Principles and service interfaces – Gateway Concepts					<b>9</b>
<b>Unit 3 COMMUNICATION PROTOCOLS</b>					
Physical Layer and Transceiver Design Considerations – MAC Protocols – Low Duty Cycle Protocols and Wakeup Concepts – Schedule – based protocols – Address and Name Management – Assignment of MAC Addresses – Time synchronization, Routing Protocols – Energy Efficient Unicast, Broadcast and multicast, Geographic routing – Data– centric Routing					<b>9</b>
<b>Unit 4 LOCALIZATION AND POSITIONING</b>					
Properties of localization and positioning – Proximity – Trilateration and Triangulation – Single–hop localization – Positioning in multi–hop environments, Topology Control – Controlling topology in flat networks – Hierarchical networks by dominating sets and clustering – Combining hierarchical topologies and power control – Adaptive node activity					<b>9</b>
<b>Unit 5 TRANSPORT LAYER AND QUALITY OF SERVICE</b>					
Coverage and deployment – Reliable data transport – Single packet delivery – Block delivery – Congestion control and rate control – Advanced application support – Security and Application specific support					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Explain the significance of sensor network mechanisms					
CO2 : Explain the various architectures of sensor network					
CO3 : Describe the roles of supporting communication protocols as how they assist Wireless Sensor Networks					
CO4 : Compare the performance of different techniques applied for node positioning and localization in wireless sensor network					
CO5 : Explain how transport layer mechanisms applied to achieve the required QoS					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	2	-	-	-	-	-	-	-	-	-	-	1	-
CO2	-	-	-	2	-	-	-	-	-	2	-	-	-	-
CO3	2	-	-	-	-	-	2	-	-	-	-	-	-	-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	-	-	-	2	-	-

**REFERENCE BOOKS:**

1. Holger Karl & Andreas Willig, "Protocols and Architectures for Wireless Sensor Networks", John Wiley, 2014
2. KazemSohraby, Daniel Minoli, &TaiebZnati, "Wireless Sensor Networks Technology, Protocols and Applications", John Wiley, 2011
3. Anna Hac, "Wireless Sensor Network Designs", John Wiley, 2003





**REFERENCE BOOKS:**

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009
2. I. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011
3. M. Tim Jones, —Artificial Intelligence: A Systems Approach(Computer Science), Jones and Bartlett Publishers, Inc.; First Edition, 2008
4. Nils J. Nilsson, —The Quest for Artificial Intelligence, Cambridge University Press, 2009

**PROGRAMME  
ELECTIVE -II [SEM-II]**

<b>CS624206: Internet of Things</b>														
<b>Course Category: Programme Elective</b>		<b>Course Type: Theory</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>						
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>						
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>To identify the components of IoT.</li> <li>To analyze various protocols of IoT.</li> <li>To design portable IoT using appropriate boards.</li> <li>To design business Intelligence and Information Security for WoT.</li> <li>To develop schemes for the applications of IOT in real time scenarios</li> </ul>														
<b>Unit 1 Introduction to IoT</b>														
Internet of Things-Components-Physical and Logical Design-IoT Enabling Technologies-IoT Deployment Templates- IoT Domains-IoT and M2M-IoT Platforms and Design Management												<b>9</b>		
<b>Unit 2 IoT Architectures</b>														
M2M High-level ETSI architecture-IETF Architecture for IoT-OGC Architecture-IoT Reference Model-Domain Model-Information Model-Functional Model-Communication Model-IoT Sample Architectures												<b>9</b>		
<b>Unit 3 IoT Protocols</b>														
Protocol Standardization for IoT-Efforts-M2M and WSN Protocols–SCADA and RFID Protocols Unified Data Standards–Protocols–IEEE 802.15.4 –BACNet Protocol–Modbus-Zigbee Architecture– Network layer–6LowPAN -CoAP-Security												<b>9</b>		
<b>Unit 4 Building IoT using Raspberry Pi and Arduino</b>														
Building IOT with RASPERRY PI-IoT Systems-Logical Design using Python-IoT Physical Devices & Endpoints-IoT Device-Building Blocks-Raspberry Pi-Board-Linux on Raspberry Pi-Raspberry Pi Interfaces-Programming Raspberry Pi with Python-Other IoT Platforms-Arduino												<b>9</b>		
<b>Unit 5 Case Studies and Practices</b>														
Real world design Constraints-Applications-Asset management, Industrial automation, smart grid, Commercial building automation, Smart cities-participatory Sensing-Data Analytics for IoT–Software & Management Tools for IoT Cloud Storage Models & Communication APIs-Cloud for IoT-Amazon Web Services for IoT												<b>9</b>		
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1 : Explain the significance of the components of IoT														
CO2 : Explain the various protocols of IoT														
CO3 : Describe the roles of portable IoT using appropriate boards														
CO4 : Compare the performance of business Intelligence and Information Security for WoT														
CO5 : Explain schemes for the applications of IOT in real time scenarios														
<b>CO PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	-	-	-	-	2	-	-	-	-	-	2	-
CO2	-	-	-	3	-	-	-	-	-	2	-	-	-	2
CO3	2	-	-	-	-	-	2	-	-	-	-	-	-	2
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	2
CO5	-	-	-	-	2	-	-	-	-	-	-	2	-	2

<b>REFERENCE BOOKS:</b>
1. HonboZhou,"The Internet of Things in the Cloud: A Middleware Perspective" - CRC Press 2012
2. Luigi Atzori, Antonio Lera, Giacomo Morabito, "The Internet of Things: A Survey", Journal on Networks, Elsevier Publications, October, 2010
3. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", Wiley, 2012

IT626204: Deep Learning					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To present the mathematical, statistical and computational challenges of building neural networks</li> <li>To study the concepts of deep learning</li> <li>To introduce dimensionality reduction techniques</li> <li>To enable the students to know deep learning techniques to support real-time applications</li> <li>To examine the case studies of deep learning techniques</li> </ul>					
<b>Unit 1 INTRODUCTION</b>					
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				9	
<b>Unit 2 DEEP NETWORKS</b>					
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				9	
<b>Unit 3 DIMENTIONALITY REDUCTION</b>					
Linear (PCA, LDA) and manifolds, metric learning - Auto encoders and dimensionality reduction in networks - Introduction to Convnet - Architectures – AlexNet, VGG, Inception, ResNet - Training a Convnet: weights initialization, batch normalization, hyperparameter optimization				9	
<b>Unit 4 OPTIMIZATION AND GENERALIZATION</b>					
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				9	
<b>Unit 5 CASE STUDY AND APPLICATIONS</b>					
Image net- Detection-Audio Wave Net-Natural Language Processing Word2Vec - Joint Detection BioInformatics- Face Recognition- Scene Understanding- Gathering Image Captions				9	
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Understand basics of deep learning					
CO2 : Implement various deep learning models					
CO3 : Realign high dimensional data using reduction techniques					
CO4 : Analyze optimization and generalization in deep learning					
CO5 : Explore the deep learning applications					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO2	-	-	-	2	2	-	-	-	-	2	-	-	-	-
CO3	-	-	2	2	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	2	2	-	-	-	-	-	-	-	-	-
CO5	-	-	-	-	2	-	-	-	-	-	-	2	-	-

**REFERENCE BOOKS:**

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 Goodfellow, YoshuaBengio, Aaron Courville, Deep Learning, MIT Press, 2016
4. Michael Nielsen, Neural Networks and Deep Learning, Determination Press, 2015

IT626205: Network Security					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To introduce principal concepts, major issues, technologies, and basic approaches in Network security.</li> <li>To review various algorithms on key management.</li> <li>To explain the principles of various authentication mechanism</li> <li>To understand the key management and distribution system.</li> <li>To familiarize the ability to examine and analyze various attacks and web security</li> </ul>					
<b>Unit 1 INTRODUCTION</b>					
An Overview of Computer Security Concepts – OSI Security Architecture - Security Attacks – Security Services –Security mechanisms- Cipher model – Substitution Techniques – Transposition Techniques – Encryption Algorithms - Confidentiality				9	
<b>Unit 2 ALGORITHMS FOR SECURITY</b>					
Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES - Blowfish-RC5 algorithm - Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange- Elliptic curve arithmetic-Elliptic curve cryptography				9	
<b>Unit 3 HASH FUNCTIONS AND DIGITAL SIGNATURES</b>					
Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – ELGamal DSS – Schnoor DSS Scheme-RSA-PSS Digital signature algorithm				9	
<b>Unit 4 KEY MANAGEMENT AND DISTRIBUTION</b>					
Symmetric Encryption – Symmetric Decryption – Distribution of public keys – X.509 Certificates – Public key Infrastructure – User Authentication protocol – Remote user Authentication principles – Kerberos-Federated Identity management- Personal Identity verification				9	
<b>Unit 5 BRIEF SURVEY OF INTERNET SECURITY</b>					
Transport level Security – Web security – SSL – Transport Layer Security – HTTPS 506 – Secure Shell SSH – Wireless Network Security – IEEE 802.11 Wireless LAN – WAP End to End Security – Electronic Mail Security – PGP – S/MIME –Domain keys identified mail- IP Security – Policies – Internet Key Exchange				9	
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Have fundamental knowledge on Network security					
CO2 : Know about the various network security algorithms					
CO3 : Understand the hash functions and digital signatures for network security					
CO4 : Analyze the key management and distribution system					
CO5 : Analyze the Internet security					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									3		
CO2	3	2	3		2						2	3	1	
CO3	3	2	2		2						2	3	1	
CO4	2											3		1
CO5	2				2							2		1

**REFERENCE BOOKS:**

1. William Stallings, Cryptography and Network Security: Principles and Practices, Seventh Edition 2016
2. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2015
3. Man Young Rhee, Internet Security Cryptographic Principles, Algorithms and Protocols, Wiley, 2003



<b>CS624209: Software Reliability and Metrics</b>														
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>										<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
											<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>Learn different definitions of software quality</li> <li>Know different notions of defects and classify them</li> <li>Understand the basic techniques of data collection and how to apply them</li> <li>Learn software metrics that define relevant metrics in a rigorous way.</li> <li>Gain confidence in ultra-high reliability.</li> </ul>														
<b>Unit 1 INTRODUCTION TO SOFTWARE RELIABILITY</b>														
Basic Concepts – Failure and Faults – Environment – Availability –Modeling –uses – requirements reliability metrics – design & code reliability metrics – testing reliability metrics													<b>9</b>	
<b>Unit 2 COMPARISON OF SOFTWARE RELIABILITY MODELS</b>														
Concepts – General Model Characteristic – Historical Development of models – Model Classification scheme – Markovian models – General concepts – General Poisson Type Models – Binomial Type Models – Poisson Type models – Fault reduction factor for Poisson Type models													<b>9</b>	
<b>Unit 3 COMPARISON OF SOFTWARE RELIABILITY MODELS</b>														
Comparison Criteria – Failure Data – Comparison of Predictive Validity of Model Groups – Recommended Models – Comparison of Time Domains – Calendar Time Modeling – Limiting Resource Concept – Resource Usage model – Resource Utilization – Calendar Time Estimation and confidence Intervals													<b>9</b>	
<b>Unit 4 FUNDAMENTALS OF MEASUREMENT</b>														
Measurements in Software Engineering – Scope of Software metrics – Measurements theory – Goal based Framework – Software Measurement Validation													<b>9</b>	
<b>Unit 5 MEASURING SOFTWARE PRODUCT</b>														
Measurement of Internal Product Attributes – Size and Structure – External Product Attributes – Measurement of Quality – Software Reliability: Measurement and Prediction													<b>9</b>	
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1 : Understand basic concepts of software reliability														
CO2 : Perform some simple statistical analysis relevant to software measurement data														
CO3 : Use from practical examples both the benefits and limitations of software metrics for quality control and assurance														
<b>CO PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-
CO2	-	-	-	3	2	-	-	-	-	2	-	-	-	2
CO3	-	-	2	2	-	-	-	-	-	2	-	-	-	2
<b>REFERENCE BOOKS:</b>														
1. John D. Musa, —Software Reliability Engineering, Tata McGraw Hill, 1999														
2. John D. Musa, Anthony Iannino, KazuhiraOkumoto, —Software Reliability – Measurement, Prediction, Application, Series in Software Engineering and Technology, McGraw Hill, 1987														

IT626205: Human Computer Interaction Techniques															
Course Category: Programme Elective		Course Type: Theory			L	T	P	C							
					3	0	0	3							
<b>COURSE OBJECTIVES:</b>															
<ul style="list-style-type: none"> <li>To know how to analyze and consider user's need in the interaction system</li> <li>To understand various interaction design techniques and models</li> <li>To understand the theory and framework of HCI</li> <li>Understand and analyze the cognitive aspects of human – machine interaction</li> </ul>															
<b>Unit 1 INTRODUCTION</b>															
Foundation – Human – Computer – Interaction – Paradigms – What is HCI – Components – Cognitive Framework – Perception and Representation – Attention and Memory Constraint – Knowledge and Mental Model – Interface Metaphors – Input – Output												9			
<b>Unit 2 DESIGN PROCESS</b>															
Interaction Styles – Interaction Design Basics – HCI in the Software Process – Design Rules - Designing Windowing Systems - User Support and On-Line Information - Designing For Collaborative Work and Virtual Environments - Principles and User-Centred Design - Methods for User-Centred Design												9			
<b>Unit 3 IMPLEMENTATION AND EVALUATION PROCESS</b>															
Implementation issues – Implementation Support - Evaluation techniques – Universal Design – User Support												9			
<b>Unit 4 MODELS</b>															
Cognitive models – Communication and collaboration models: Models of the system – Models of the System – Modeling Rich Interaction												9			
<b>Unit 5 APPLICATIONS</b>															
Socio – organization issues and stakeholder requirements - Ubiquitous Computing - Context – aware User Interfaces - Hypertext, multimedia and the World Wide Web												9			
<b>TOTAL: 45 PERIODS</b>															
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to															
CO1 : Develop good design for human machine interaction system															
CO2 : Design new interaction model to satisfy all types of customers															
CO3 : Evaluate the usability and effectiveness of various products															
CO4 : To know how to apply interaction techniques for systems															
<b>CO PO MAPPING</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	-	2	-	2	-	-	-	-	-	-	-	-	1	-	
CO2	2	2	-	2	-	-	-	-	-	2	-	-	-	-	
CO3	-	-	2	3	-	-	-	-	-	-	-	-	-	-	
CO4	2	-	-	2	2	-	-	-	-	-	-	-	-	-	
CO5															
<b>REFERENCE BOOKS:</b>															
1. Alan Dix, Janet Finlay, Gregory D.Abowd, Russell Beale, “Human Computer Interaction”, Third Edition, Pearson Education, 2004															
2. J. Preece, Y. Rogers, H. Sharp, D. Benyon, S. Holland and T. Carey. “Human – Computer Interaction”, Addison Wesley, 1994															
3. John M.Carrol, “Human Computer Interaction in the New Millenium”, Pearson Education, 2002															

**PROGRAMME  
ELECTIVE -III [SEM-II]**

IT626207: Advanced Computer Graphics and Animations															
Course Category: Programme Elective		Course Type: Theory			L	T	P	C							
					3	0	0	3							
<b>COURSE OBJECTIVES:</b>															
<ul style="list-style-type: none"> <li>To learn the output primitives like line, circle and ellipse using algorithms.</li> <li>To study the 2-D transformations and clipping.</li> <li>To explore 3-D object representations and transformations.</li> <li>To explore graphics programming using OpenGL.</li> <li>To enable the students to understand various 3-D modeling and animation tools</li> </ul>															
<b>Unit 1 INTRODUCTION</b>															
Applications of Computer Graphics - Overview of Graphics Systems - Input Devices - Output Primitives: Points and Lines - Line Drawing Algorithms - Mid-Point Circle and Ellipse Algorithms - Attributes of Output Primitives: Line, Curve, Color, Area-Fill, Character, Bundled Attributes - Antialiasing												<b>9</b>			
<b>Unit 2 TWO-DIMENSIONAL CONCEPTS</b>															
Two-Dimensional Geometric Transformations - Two-Dimensional Viewing - Two-Dimensional Point – Cohen Sutherland Line Clipping - Sutherland-Hodgeman Polygon Clipping - Weiler-Atherton Polygon Clipping - Text Clipping - Exterior Clipping												<b>9</b>			
<b>Unit 3 THREE-DIMENSIONAL CONCEPTS</b>															
Three-Dimensional Display Methods - Three-Dimensional Object Representations: Polygon - Quadric Surfaces – Splines – Bezier curves and surfaces – Octree – BSP trees – Visualization of Datasets. Three-Dimensional Transformations: Translation – Rotation – Scaling – Reflection - Shearing - Composite transformation												<b>9</b>			
<b>Unit 4 GRAPHICS PROGRAMMING WITH OPENGL</b>															
Drawing 3D Scenes – Perform Transformations - Colors And Light - Adding Texture and Shadows - Using Shading Models. Understanding 3D Modeling and Animation Tools like 3D Studio Max, Maya, Blender												<b>9</b>			
<b>Unit 5 Animation</b>															
Multimedia I/O Technologies – Digital Voice and Audio – Video Image and Animation – Full Motion Video–Storage and Retrieval Technologies- Animation Principles - Animation Drawing - Animation Marketing and Management - Matte Painting												<b>9</b>			
<b>TOTAL: 45 PERIODS</b>															
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to															
CO1 : Develop the line, circle and ellipse drawing algorithms															
CO2 : Apply the two dimensional geometric transformations and 2-D clipping															
CO3 : Represent 2-D objects and do geometric transformations															
CO4 : Perform clipping and Detecting the visible surfaces in 3-D objects															
CO5 : Apply transformation, texture, shadow and shading in 3-D objects using OpenGL and Animation															
<b>CO PO MAPPING</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	
CO2	-	2	-	-	-	-	-	-	-	2	-	-	-	-	
CO3	-	-	2	-	-	-	-	-	-	2	-	-	-	-	
CO4	-	-	-	2	-	-	-	-	-	-	-	-	-	-	
CO5	-	-	2	-	-	-	-	-	-	-	-	2	-	-	

<b>REFERENCE BOOKS:</b>
1. Donald Hearn and M. Pauline Baker, "Computer Graphics C Version", Second Edition, Pearson Education, 2012
2. James D. Foley, Andries Van Dam, Steven K. Feiner, John F. Hughes, "Computer Graphics Principles and Practice", Second Edition, Pearson Education 2007
3. F. S. Hill, "Computer Graphics using OpenGL", Second edition, Pearson Education 2003

<b>CS624211: Software Quality Assurance and Testing</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To understand the basics of testing, test planning &amp; design and test team organization</li> <li>• To study the various types of test in the life cycle of the software product.</li> <li>• To build design concepts for system testing and execution</li> <li>• To learn the software quality assurance ,metrics, defect prevention techniques</li> <li>• To learn the techniques for quality assurance and applying for applications</li> </ul>					
<b>Unit 1 SOFTWARE TESTING - CONCEPTS, ISSUES, AND TECHNIQUES</b>					
Quality Revolution, Verification and Validation, Failure, Error, Fault, and Defect, Objectives of Testing, Testing Activities, Test Case Selection White-Box and Black ,test Planning and design, Test Tools and Automation, . Power of Test. Test Team Organization and Management-Test Groups, Software Quality Assurance Group ,System Test Team Hierarchy, Team Building				<b>9</b>	
<b>Unit 2 SYSTEM TESTING</b>					
System Testing - System Integration Techniques-Incremental, Top Down Bottom Up Sandwich and Big Bang, Software and Hardware Integration, Hardware Design Verification Tests, Hardware and Software Compatibility Matrix Test Plan for System Integration. Builtin Testing. functional testing - Testing a Function in Context. Boundary Value Analysis, Decision Tables. acceptance testing - Selection of Acceptance Criteria, Acceptance Test Plan, Test Execution Test. software reliability - Fault and Failure, Factors Influencing Software, Reliability Models				<b>9</b>	
<b>Unit 3 SYSTEM TEST CATEGORIES</b>					
System test categories Taxonomy of System Tests, Interface Tests Functionality Tests. GUI Tests, Security Tests Feature Tests, Robustness Tests, Boundary Value Tests Power Cycling Tests Interoperability Tests, Scalability Tests, Stress Tests, Load and Stability Tests, Reliability Tests, Regression Tests, Regulatory Tests. Test Generation from FSM models- State-Oriented Model. Finite-State Machine Transition Tour Method, Testing with State Verification. Test Architectures-Local, distributed, Coordinated, Remote. system test design- Test Design Factors Requirement Identification, modeling a Test Design Process Test Design Preparedness, Metrics, Test Case Design Effectiveness. system test execution-Modeling Defects, Metrics for Monitoring Test Execution .Defect Reports, Defect Causal Analysis, Beta testing, measuring Test Effectiveness				<b>9</b>	
<b>Unit 4 SOFTWARE QUALITY</b>					
Software quality - People's Quality Expectations, Frameworks and ISO-9126, McCall's Quality Factors and Criteria – Relationship. Quality Metrics. Quality Characteristics ISO 9000:2000 Software Quality Standard. Maturity models- Test Process Improvement,Testing Maturity Model				<b>9</b>	
<b>Unit 5 SOFTWARE QUALITY ASSURANCE</b>					
Quality Assurance - Root Cause Analysis, modeling, technologies, standards and methodologies for defect prevention. Fault Tolerance and Failure Containment - Safety Assurance and Damage Control, Hazard analysis using fault-trees and event-trees. Comparing Quality Assurance Techniques and Activities. QA Monitoring and Measurement, Risk Identification for Quantifiable Quality Improvement. Case Study: FSM-Based Testing of Web-Based Applications				<b>9</b>	

**TOTAL: 45 PERIODS**

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

CO1 : Perform functional and non-functional tests in the life cycle of the software product

CO2 : Understand system testing and test execution process

CO3 : Identify defect prevention techniques and software quality assurance metrics

CO4 : Apply techniques of quality assurance for typical applications

CO5 : Analyze the Quality of Software

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	-	2	-	1	-	-	-	-	-	-	-	-	-
CO2	3	2	-	-	-	-	-	-	-	3	-	-	-	-
CO3	-	-	3	2	-	-	-	-	-	-	-	-	-	-
CO4	-	-	-	2	2	-	-	-	-	-	-	-	-	-
CO5														

**REFERENCE BOOKS:**

1. Software Testing And Quality Assurance-Theory and Practice, Kshirasagar Nak Priyadarshi Tripathy, John Wiley & Sons Inc,2008
2. Software Quality Engineering: Testing, Quality Assurance, and Quantifiable Improvement, Jeff Tian, John Wiley & Sons, Inc., Hoboken, New Jersey. 2005
3. Software Quality Assurance - From Theory to Implementation, Daniel Galin, Pearson Education Ltd UK, 2004
4. Software Quality Assurance, MilindLimaye, TMH ,New Delhi, 2011

<b>CS624212 – Cognitive Computing</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To appreciate the need of Cognitive Computing Techniques.</li> <li>• To learn different types of sets which can handle imprecise data values</li> <li>• To develop systems which have learning capabilities.</li> <li>• To learn techniques to optimize the results and find the optima</li> </ul>					
<b>Unit 1 Psychology and Neuroscience</b>					
Philosophy: Mental-physical Relation – From Materialism to Mental Science – Detour before the naturalistic turn – The Philosophy of Science – The Mind in Cognitive Science – Logic and the Sciences of the Mind – Psychology: Place of Psychology within Cognitive Science -Science of Information Processing – Neurosciences: Cognitive Neuroscience – Perception -Decision – Learning and Memory – Language Understanding and Processing					<b>9</b>
<b>Unit 2 Probabilistic Programming Language</b>					
Web PPL Language – Syntax – Using Javascript Libraries – Manipulating probability types and distributions – Finding Inference – Exploring random computation – Coroutines: Functions that receive continuations -Enumeration – Other basic computation					<b>9</b>
<b>Unit 3 Fuzzy sets and fuzzy logic</b>					
Introduction to fuzzy logic, classical and fuzzy sets, overview of fuzzy sets, membership function, fuzzy rule generation, operations on fuzzy sets: compliment, intersection, union, combinations on operations, aggregation operation. Fuzzy Extension Principles, Defuzzification. Fuzzy Rule bases, Development of Fuzzy Logic based Expert Systems. CASE STUDIES					<b>9</b>
<b>Unit 4 Neural Networks &amp; Rough Sets</b>					
Overview of biological neurons, Mathematical model of Neuron, Perceptron and Multi Layer Perceptron, Learning in Artificial Neural Networks; Supervised, Unsupervised and Competitive Learning paradigms; Learning rules and Functions, Back propagation algorithm, Rough Sets. Upper and Lower Approximations, Boundary Region, Decision Tables and Decision Algorithms. Properties of Rough Sets. Rough Membership, Reducts. Discernibility Matrix and Discernibility Functions. Generation of Inference Rules					<b>9</b>
<b>Unit 5 Evolutionary Algorithms and Hybrid Algorithms</b>					
Introduction, Evolutionary algorithms - Genetic Algorithm: History, terminology, biological background, creation of offspring, working principles of genetic algorithms, fitness function, Roulette wheel selection, Boltzmann selection, cross over mutation, inversion, deletion, and duplication, generation cycle , Swarm Optimization –Part Swarm Optimization and Ant Colony Optimization. Differential Evolutionary Algorithm					<b>9</b>
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Understand the Philosophy of Science					
CO2 : Able to realize importance and apply Computing techniques for real world problem solving					
CO3 : Able to represent the imprecise information using sets and develop inference systems based on these					



CO4 : Develop learning systems

CO5 : Learn and practice various optimization algorithms for real world problems solving

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2											
CO2	2	2								3				
CO3	3		2											
CO4	2			3										
CO5					3									

**REFERENCE BOOKS:**

1. Robert A. Wilson, Frank C. Keil, “The MIT Encyclopedia of the Cognitive Sciences”, The MIT Press, 1999
2. Noah D. Goodman, Andreas Stuhlmuller, “The Design and Implementation of Probabilistic Programming Languages”, Electronic version of book, <https://dippl.org/>
3. Noah D. Goodman, Joshua B. Tenenbaum, The ProbMods Contributors, “Probabilistic Models of Cognition”, Second Edition, 2016, <https://probmods.org>

<b>CS624213: SOCIAL NETWORK ANALYSIS</b>					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• Gain knowledge about the current Web development and emergence of Social Web</li> <li>• Study about the modeling, aggregating</li> <li>• Learn knowledge representation of Semantic Web</li> <li>• Learn about the extraction and mining tools for Social networks</li> <li>• Gain knowledge on Web personalization and Web Visualization of Social networks</li> </ul>					
<b>Unit 1 INTRODUCTION TO SOCIAL NETWORK ANALYSIS</b>					
Introduction to Web - Limitations of current Web – Development of Semantic Web – Emergence of the Social Web - Network analysis - Development of Social Network Analysis - Key concepts and measures in network analysis - Electronic sources for network analysis - Electronic discussion networks, Blogs and online communities				<b>9</b>	
<b>Unit 2 MODELLING, AGGREGATING AND KNOWLEDGE REPRESENTATION</b>					
Ontology and their role in the Semantic Web - Ontology-based Knowledge Representation - Ontology languages for the Semantic Web – RDF and OWL - Ontological representation of social individuals, Ontological representation of social relationships, Aggregating and reasoning with social network data, Advanced Representations				<b>9</b>	
<b>Unit 3 EXTRACTION AND MINING COMMUNITITES IN WEB SOCIAL NETWORKS</b>					
Extracting evolution of Web Community from a Series of Web Archive - Detecting Communities in Social Networks - Definition of Community - Evaluating Communities - Methods for Community Detection & Mining - Applications of Community Mining Algorithms - Tools for Detecting Communities Social Network Infrastructures and Communities				<b>9</b>	
<b>Unit 4 PREDICTING HUMAN BEHAVIOR AND PRIVACY ISSUES</b>					
Understanding and Predicting Human Behaviour for Social Communities - User Data Management, Inference and Distribution - Enabling New Human Experiences - Reality Mining - Context-Awareness - Privacy in Online Social Networks - Trust in Online Environment - Trust Models Based on Subjective Logic - Trust Network Analysis - Combining Trust and Reputation				<b>9</b>	
<b>Unit 5 VISUALIZATION AND APPLICATIONS OF SOCIAL NETWORKS</b>					
Graph Theory- Centrality- Clustering - Node-Edge Diagrams, Matrix representation, Visualizing Online Social Networks, Visualizing Social Networks with Matrix-Based Representations- Matrix + Node-Link Diagrams, Hybrid Representations - Applications - Covert Networks - Community Welfare - Collaboration Networks - CoCitation Networks				<b>9</b>	
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Apply knowledge for current Web development in the era of Social Web					
CO2 : Model, aggregate and represent knowledge for Semantic Web					
CO3 : Design extraction and mining tools for Social networks					
CO4 : Develop personalized web sites and visualization for Social networks					
CO5 : Design Web personalization and Visualization for Social networks					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3					3								
CO2					2					2				
CO3	3	3	2											
CO4		2	2											
CO5			2											

**REFERENCE BOOKS:**

1. Peter Mika, —Social Networks and the Semantic Web, First Edition, Springer 2007
2. Borko Furht, —Handbook of Social Network Technologies and Applications, 1st Edition, Springer, 2010
3. Peter Mika, —Social networks and the Semantic Web, Springer, 1st edition 2007
4. Dion Goh and Schubert Foo, —Social information Retrieval Systems: Emerging Technologies and Applications for Searching the Web Effectively, IGI Global Snippet, 2008

CS624215: Block Chain Technologies					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To learn the various cryptography primitives used in block chain.</li> <li>To study the design principles of block chain.</li> <li>To understand the various consensus algorithms.</li> <li>To study the block chain in networking.</li> <li>To learn the enhancements of block chain technologies</li> </ul>					
<b>Unit 1 CRYPTOGRAPHY IN BLOCKCHAIN</b>					
Blockchain Definitions – Blockchain versus Databases – History – Motivation – Characteristics – Types – Overview - Hashing in Blockchain – Linking blocks in blockchain – Linking blocks using SHA256 – Block structure – Blockchain functionality – Creating Blockchain – Byzantine failure problem in blockchain – Digital signatures in blockchain – Blockchain wallets				9	
<b>Unit 2 BLOCKCHAIN DESIGN PRINCIPLES</b>					
Networked Integrity – Distributed Power- Value as Incentive – Security – Privacy – Rights Preserved – Inclusion – Centralized Registries versus Distributed Ledgers – Public versus Private Ledgers – Transparency as a Strategic Risk – Transparency as a Strategic Asset - Zero Knowledge Proofs				9	
<b>Unit 3 CONSENSUS ALGORITHMS</b>					
Proof of Work – Pure Stake Based Consensus – Proof of Stake - Leased Proof of Stake – Delegated Proof of Stake – Hybrid Form of PoS and PoW – Practical Byzantine Fault Tolerance – Ripple –Tendermint – Proof of Elapsed Time – Proof of Activity – Proof of Burn – Hyperledger Fabric				9	
<b>Unit 4 NETWORKING IN BLOCK CHAIN</b>					
Peer – to –peer Networking – Network Discovery – Block Synchronization – Building a simple Blockchain in P2P Network – Validating new Block – Selecting Longest chain – Block Exchange between Peers – Application InterfacesBlockchain Networks – Testnet – Regtest – Blockchain in 5G – Blockchain in Social Networking – Blockchain for IoT				9	
<b>Unit 5 BLOCKCHAIN OPTIMIZATIONS AND ENHANCEMENTS</b>					
Blockchain Optimizations – Transaction Exchange – Off-chain Transactions – Block size improvements – Blockchain enhancements – Sharding – Evolution of consensus algorithm – Proof of Stake – Proof of Activity – Byzantine Fault Tolerance Consensus Models – Proof of Elapsed Time – Cross-chain Protocol – Privacy Enhancement – Blockchain Security – Transaction Security Model – Decentralized Security Model – Attacks on Blockchain				9	
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1 : Implement the required cryptography primitives for block chain systems					
CO2 : Work with various block chain design principles					
CO3 : Implement with various consensus algorithms					
CO4 : Equip networks with the various block chain techniques					
CO5 : Work with block chain optimization techniques					

**CO PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2											
CO2	2	2								3				
CO3	3		2											
CO4	2			3										
CO5				2	3									

**REFERENCE BOOKS:**

1. Koshik Raj, "Foundations of Blockchain", Packt Publishers, 2019
2. S. Shukla, M. Dhawan, S. Sharma and S. Venkatesan, "Blockchain Technology: Cryptocurrency and Applications", Oxford University Press, 2019
3. Josh Thompson, "Blockchain: The Blockchain for Beginnings, Guild to Blockchain Technology and Blockchain Programming", Create Space Independent Publishing Platform, 2017
4. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", Oreilly Media, 1st Edition, 2014

**PROGRAMME  
ELECTIVE -IV**

IT626208 - PATTERN RECOGNITION					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>		<ul style="list-style-type: none"> <li>To know the fundamental algorithms for pattern recognition</li> <li>To understand the overview of pattern recognition</li> <li>To know the major approaches in statistical pattern recognition.</li> <li>To know the major approaches in syntactic pattern recognition.</li> <li>To know several unsupervised learning and clustering algorithms</li> </ul>			
<b>UNIT 1: BASICS OF PROBABILITY, RANDOM PROCESSES AND LINEAR ALGEBRA</b>				<b>9</b>	
Probability: independence of events, conditional and joint probability, Bayes' theorem; Random Processes: Stationary and nonstationary processes, Expectation, Autocorrelation, Cross-Correlation, spectra; Linear Algebra: Inner product, outer product, inverses, eigen values, eigen vectors; Bayes Decision Theory					
<b>UNIT 2: PATTERN RECOGNITION OVERVIEW</b>				<b>9</b>	
Typical Pattern Recognition System, Patterns and Features Extraction, Training and Learning in Pattern Recognition system, Different types of Pattern Recognition Approaches – Statistical, Syntactic, Neural. Discriminant functions.					
<b>UNIT 3: STATISTICAL PATTERN RECOGNITION</b>				<b>9</b>	
Parametric estimation and supervised learning, Maximum likelihood estimation, Bayesian parameter estimation, Non-parametric approaches - Parzen window, k-NN estimation.					
<b>UNIT 4: SYNTACTIC PATTERN RECOGNITION</b>				<b>9</b>	
Grammar Based Approaches, Elements of Formal Grammars, Parsing Concepts – Parsing Algorithm, Transition Networks in Parsing, Higher Dimensional Grammars, Stochastic Grammars, Graphical Approaches – Graph Isomorphism, Attributed Graphs					
<b>UNIT 5: UNSUPERVISED LEARNING AND CLUSTERING</b>				<b>9</b>	
Mixture Models and EM – K-Means Clustering – Dirichlet Process Mixture Models – Spectral Clustering – Hierarchical Clustering – The Curse of Dimensionality – Dimensionality Reduction –Principal Component Analysis – Latent Variable Models (LVM) – Latent Dirichlet Allocation (LDA).					
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1: Acquire the knowledge of fundamental algorithms related to pattern recognition					
CO2: Learn the pattern recognition approaches					
CO3: Apply the major approaches in statistical pattern recognition.					
CO4: Apply the major approaches in syntactic pattern recognition.					
CO5: Discusses several unsupervised learning and clustering algorithms suitable for pattern classification					

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2							2		3	2	
CO2	2	2	2							2		3	3	
CO3	2	2	2							2		2		3
CO4	2	2	2							2		2		3
CO5	2	3	2							2		2		2

**1- low, 2 - medium, 3 - high, '-' no correlation**

**REFERENCE BOOKS:**

1. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2011.
2. Richard O. Duda, Peter E. Hart, David G. Stork, "Pattern Classification", Second Edition., Wiley India, 2006.
3. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer (India) Private Limited, 2013.
4. Ian H. Witten, Eibe Frank, "Data Mining: Practical Machine Learning Tools and Techniques", Second Edition, Elsevier India, 2011.
5. Sergios Theodoridis, Konstantinos Koutroumbas, "Pattern Recognition", Fourth Edition., China Machine Press, 2009
6. William Gibson, "Pattern Recognition", Penguin, 2011

**WEB RESOURCES:**

1. <https://www.v7labs.com/blog/pattern-recognition-guide>
2. <https://www.simplilearn.com/pattern-recognition-and-ml-article>



IT626209 - PARALLEL COMPUTING														
Course Category: Programme Elective				Course Type: Theory				L	T	P	C			
								3	0	0	3			
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>To study the scalability and clustering issues and the technology necessary for them.</li> <li>To understand the technologies enabling parallel computing.</li> <li>To study the different types of interconnection networks.</li> <li>To study the different parallel programming models.</li> <li>To study the software support needed for shared memory programming.</li> </ul>														
<b>UNIT 1: SCALABILITY AND CLUSTERING</b>											<b>9</b>			
Evolution of Computer Architecture – Dimensions of Scalability – Parallel Computer Models – Basic Concepts of Clustering – Scalable Design Principles – Parallel Programming Overview – Processes, Tasks and Threads – Parallelism Issues – Interaction/ Communication Issues – Semantic Issues In Parallel Programs.														
<b>UNIT 2: ENABLING TECHNOLOGIES</b>											<b>9</b>			
System Development Trends – Principles of Processor Design – Microprocessor Architecture Families – Hierarchical Memory Technology – Cache Coherence Protocols – Shared Memory Consistency – Distributed Cache Memory Architecture – Latency Tolerance Techniques – Multithreaded Latency Hiding.														
<b>UNIT 3: SYSTEM INTERCONNECTS</b>											<b>9</b>			
Basics of Interconnection Networks – Network Topologies and Properties – Buses, Crossbar and Multistage Switches, Software Multithreading – Synchronization Mechanisms.														
<b>UNIT 4: PARALLEL PROGRAMMING</b>											<b>9</b>			
Paradigms and Programmability – Parallel Programming Models – Shared Memory Programming.														
<b>UNIT 5: MESSAGE PASSING PROGRAMMING</b>											<b>9</b>			
Message Passing Paradigm – Message Passing Interface – Parallel Virtual Machine.														
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1: Know the scalability and clustering issues and the technology necessary for them.														
CO2: Build the technologies enabling parallel computing.														
CO3: Build the different types of interconnection networks.														
CO4: Design the different parallel programming models.														
CO5: Develop the software support needed for shared memory programming.														
<b>CO-PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									3	2	
CO2	2	2	2									3	3	
CO3	2	2	2									2		3
CO4	2	2	2									2		3
CO5	2	3	2									2		2
<b>1- low, 2 - medium, 3 - high, '-' no correlation</b>														
<b>REFERENCE BOOKS:</b>														
1.Kai Hwang and Zhi.WeiXu, “Scalable Parallel Computing”, Tata McGraw-Hill, New Delhi, 2016.														
2.David E. Culler &Jaswinder Pal Singh, “Parallel Computing Architecture: A Hardware/Software Approach”, Morgan Kaufman Publishers, 2000.														
3.Michael J. Quinn, “Parallel Programming in C with MPI &OpenMP”, Tata McGraw-														

Hill, New Delhi, 2005.

4. Anubhav Pradhan, Anil V Deshpande, "Mobile Apps Development", First Edition, Wiley India, 2013

5. Joseph JaJa, "Introduction to Parallel Algorithms", Addison-Wesley, 2000.

6. Selim G. Akl, "The Design and Analysis of Parallel Algorithms", Prentice Hall, New Jersey, 2016

**WEB RESOURCES:**

1. <https://www.ibm.com/topics/parallel-computing>

2. <https://appicontemplate.com/>

IT626210 - MOBILE APPLICATION DEVELOPMENT														
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>				<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>						
					<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>						
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>To understand the need and characteristics of mobile applications</li> <li>To design the right user interface for mobile application</li> <li>To understand the design issues in the development of mobile applications.</li> <li>To understand the development procedure for mobile application.</li> <li>To develop mobile applications using various tools and platforms</li> </ul>														
<b>UNIT 1: INTRODUCTION</b>													<b>9</b>	
Mobile Application Model – Infrastructure and Managing Resources – Mobile Device Profiles – Frameworks and Tools.														
<b>UNIT 2: USER INTERFACE</b>													<b>9</b>	
Generic UI Development - Multimodal and Multichannel UI –Gesture Based UI – Screen Elements and Layouts – Voice XML.														
<b>UNIT 3: APPLICATION DESIGN</b>													<b>9</b>	
Memory Management – Design Patterns for Limited Memory – Work Flow for Application development – Java API – Dynamic Linking – Plugins and rule of thumb for using DLLs – Concurrency and Resource Management.														
<b>UNIT 4: MOBILE OS</b>													<b>9</b>	
Mobile OS: Android, iOS – Android Application Architecture – Android basic components – Intents and Services – Storing and Retrieving data – Packaging and Deployment – Security and Hacking.														
<b>UNIT 5: APPLICATION DEVELOPMENT</b>													<b>9</b>	
Communication via the Web – Notification and Alarms – Graphics and Multimedia: Layer Animation, Event handling and Graphics services – Telephony – Location based services														
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1: Know the features of the basics of mobile application development frameworks and tools														
CO2: Able to develop a UI for mobile application														
CO3: Design mobile applications that manages memory dynamically														
CO4: Build applications based on mobile OS like Android, iOS														
CO5: Build location based services														
<b>CO-PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2	2	3	2	
CO2	2	2	2						2	3	2	3	3	
CO3	2	2	2						3	2	2	2		3
CO4	2	2	2						2	2	2	2		3
CO5	2	3	2						2	3	3	2		2
<b>1- low, 2 - medium, 3 - high, '-' no correlation</b>														
<b>REFERENCE BOOKS:</b>														
1.Reto Meier, “Professional Android 4 Application Development”,Wiley, First Edition, 2014.														
2.ZigurdMednieks, LairdDornin, G. Blake Meike, Masumi Nakamura, “Programming Android”, O’Reilly, 2nd Edition, 2016.														
3.Alasdair Allan, “iPhone Programming”, O’Reilly, First Edition, 2013.														
4.Anubhav Pradhan, Anil V Deshpande, “ Mobile Apps Development”, First Edition, Wiley														

India, 2013
5. Barry Burd, "Android Application Development All in one for Dummies", First Edition, Wiley India, 2011
6. Erik Hellman, "Android programming-Pushing the Limits", First Edition, Wiley India Pvt Ltd, 2014.
<b>WEB RESOURCES:</b>
1. <a href="https://www.ibm.com/topics/mobile-application-development">https://www.ibm.com/topics/mobile-application-development</a>
2. <a href="https://appicontemplate.com/">https://appicontemplate.com/</a>

IT626211 - VIRTUAL AND AUGMENT REALITY						
Course Category: Programme Elective	Course Type: Theory	L	T	P	C	
		3	0	0	3	
<b>COURSE OBJECTIVES:</b>						
<ul style="list-style-type: none"> <li>To study about Fundamental Concept and Components of Virtual Reality</li> <li>To study about Interactive Techniques in Virtual Reality</li> <li>To study about Visual Computation in Virtual Reality</li> <li>To study about Augmented and Mixed Reality and Its Applications</li> <li>To know about I/O Interfaces and its functions.</li> </ul>						
<b>UNIT 1: INTRODUCTION TO VIRTUAL REALITY</b>						<b>9</b>
Introduction, Fundamental Concept and Components of Virtual Reality. Primary Features and Present Development on Virtual Reality. Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: Introduction, The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading 24 algorithms, Radiosity, Hidden Surface Removal, Realism Stereographic image.						
<b>UNIT 2: INTERACTIVE TECHNIQUES IN VIRTUAL REALITY</b>						<b>9</b>
Introduction, from 2D to 3D, 3D spaces curves, 3D boundary representation Geometrical Transformations: Introduction, Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.						
<b>UNIT 3: VISUAL COMPUTATION IN VIRTUAL REALITY</b>						<b>9</b>
Animating the Virtual Environment: Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in betweening, free from deformation, particle system. Physical Simulation: Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.						
<b>UNIT 4: AUGMENTED AND MIXED REALITY</b>						<b>9</b>
Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.						
<b>UNIT 5: I/O INTERFACE IN VR &amp; APPLICATION OF VR</b>						<b>9</b>
Human factors: Introduction, the eye, the ear, the somatic senses. VR Hardware: Introduction, sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Introduction, Modeling virtual world, Physical simulation, VR toolkits, Introduction to VRML, Input -- Tracker, Sensor, Digitalglobe, Movement Capture, Video-based Input, 3D Menus & 3DScanner etc. Output -- Visual /Auditory / Haptic Devices. VR Technology in Film & TV Production. VR Technology in Physical Exercises and Games. Demonstration of Digital Entertainment by VR.						
<b>TOTAL: 45 PERIODS</b>						
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to						
CO1: Able to know the Fundamental Concept and Components of Virtual Reality						
CO2: Able to know the Interactive Techniques in Virtual Reality						

CO3: Get the knowledge about Visual Computation in Virtual Reality

CO4: Able to know the concepts of Augmented and Mixed Reality and Its Applications

CO5: Know about I/O Interfaces and its functions.

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2	2	3	3	
CO2	2	2	2						2	3	2	3	3	
CO3	2		2						3	2	3	2	2	2
CO4	2	2	2						2	2	2	2		3
CO5	2	3	2						2	3	2	2		2

**1 - low, 2 - medium, 3 - high, '-' no correlation**

**REFERENCE BOOKS:**

1. Alan B. Craig, "Understanding Augmented Reality, Concepts and Applications", Morgan Kaufmann, First Edition 2013.

2. Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009.

3. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.

4. Adams, "Visualizations of Virtual Reality", Tata McGraw Hill, 2000.

5. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application and Design", Morgan Kaufmann, 2008

6. Burdea, G. C. and P. Coffet. Virtual Reality Technology, Second Edition. Wiley-IEEE Press, 2003/2006.

**WEB RESOURCES:**

1. <http://virtualrealityforeducation.com/resources/>

2. [https://www.fusionvr.in/industry-academic-alliance-program?gclid=Cj0KCQjwocShBhCOARIsAFVYq0gk9Ihi2C8xFtgTEQahsKUeax\\_sMHHKbiYPPqNjFRldyW20i62iexcaAvtNEALw\\_wcB](https://www.fusionvr.in/industry-academic-alliance-program?gclid=Cj0KCQjwocShBhCOARIsAFVYq0gk9Ihi2C8xFtgTEQahsKUeax_sMHHKbiYPPqNjFRldyW20i62iexcaAvtNEALw_wcB)

IT626212 - MULTIMEDIA DATABASES															
Course Category: Programme Elective		Course Type: Theory				L	T	P	C						
						3	0	0	3						
<b>COURSE OBJECTIVES:</b>															
<ul style="list-style-type: none"> <li>To familiarize about the database indexing methods and different multidimensional data structures.</li> <li>To learn about text database, its storage and retrieval</li> <li>To learn about image database, its storage and retrieval</li> <li>To understand about Audio and Video Storage.</li> <li>To understand design and architecture of a Multimedia Database.</li> </ul>															
<b>UNIT 1: DATABASE INDEXING METHODS</b>														<b>9</b>	
Hashing – B-trees – Secondary Key Access Methods – Inverted Files – Point Access Methods (PAMs) – Spatial Access Methods (SAMs) – Space Filling Curves – Transformation to Higher-D Points – Multidimensional Data Structures – K-D Trees – Point Quadrees– The MX-Quadtree– RTrees.															
<b>UNIT 2: TEXT DATABASES</b>														<b>9</b>	
Precision and Recall – Stop Lists – Word Stems and Frequency Tables – Latent Semantic Indexing – TV-Trees – Indexing Text and DNA Strings – Access Methods for Text – Full Text Scanning – Inversion – Signature Files – Vector Space Model and Clustering.															
<b>UNIT 3: IMAGE RETRIEVAL MECHANISMS</b>														<b>9</b>	
Image Databases – Raw Images – Compressed Image Representations – Similarity Based Retrieval – Alternative Image DB Paradigms – Representing Image DBs with Relations – Representing Image DBs with R-Trees – Retrieving Images by Spatial Layout – Implementations.															
<b>UNIT 4: AUDIO/VIDEO DATABASES</b>														<b>9</b>	
Audio Databases – A General Model of Audio Data – Capturing Audio Content through Discrete Transformation – Indexing Audio Data– Video Databases – Organizing Content of a Single Video – Querying Content of Video Libraries – Video Segmentation.															
<b>UNIT 5: MULTIMEDIA DATABASE DESIGN</b>														<b>9</b>	
Design and Architecture of a Multimedia Database – Organizing Multimedia Data based on the Principle of Uniformity – Media Abstractions – Query Languages for Retrieving Multimedia Data.															
<b>TOTAL: 45 PERIODS</b>															
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to															
CO1: Apply database indexing methods for efficient storage and retrieval of multimedia content.															
CO2: Work with Text databases, its storage and retrieval.															
CO3: Demonstrate about the Image database, its storage and retrieval.															
CO4: Formulate and generalize the use of audio and video databases for real time multimedia applications.															
CO5: Apply multimedia database design for multimedia architecture.															
<b>CO-PO MAPPING</b>															
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	3	2	2						2	2	2	3	3		
CO2	2	2	2						2	3	2	3	3		
CO3	2	3	2						3	2	3	2	2	2	
CO4	2	2	2						3	2	3	2		3	
CO5	2	3	2						2	2	2	2		2	
<b>1- low, 2 - medium, 3 - high, '-' no correlation</b>															

**REFERENCE BOOKS:**

1.Christos Faloutsos, “Searching Multimedia databases by Content”, Kluwer Academic Publishers,2011.

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

3.Lynne Dunckley, “Multimedia Databases: An Object Relational Approach”, Pearson Education, 2003.

4.S. Khoshafian, A. B. Baker, “Multimedia and Imaging Databases”, Elsevier, 1996.

5.C. Kingsley Nwosu, “Multimedia Database Systems: Design and Implementation Strategies”, Kluwer Academic Publishers,2012.

6.R. Elmasri, S. B. Navathe, “Fundamentals of Database Systems”, Seventh edition, Pearson Education,2017.

**WEB RESOURCES:**

1. <https://researchguides.dartmouth.edu/c.php?g=59724&p=382829>

2. <https://www.tutorialspoint.com/Multimedia-Databases>



**PROGRAMME  
ELECTIVE -V**

<b>CS624221 - MULTIMEDIA AND COMPRESSION TECHNIQUES</b>														
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>			<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>							
				<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>							
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>To understand the basic ideas of compression algorithms related to multimedia components</li> <li>To learn the Text compression algorithms</li> <li>To get the knowledge of Image compression algorithms</li> <li>To know the features of Audio compression algorithms</li> <li>To know the features of Video compression algorithms</li> </ul>														
<b>UNIT 1: FUNDAMENTALS OF COMPRESSION</b>												<b>9</b>		
Introduction To multimedia – Graphics, Image and Video representations – Fundamental concepts of video, digital audio – Storage requirements of multimedia applications – Need for compression – Taxonomy of compression Algorithms - Elements of Information Theory – Error Free Compression – Lossy Compression.														
<b>UNIT 2: TEXT COMPRESSION</b>												<b>9</b>		
Huffman coding – Adaptive Huffman coding – Arithmetic coding – Shannon-Fano coding – Dictionary techniques – LZW family algorithms.														
<b>UNIT 3: IMAGE COMPRESSION</b>												<b>9</b>		
Image Compression: Fundamentals — Compression Standards – JPEG Standard – Sub-band coding – Wavelet Based compression – Implementation using Filters – EZW, SPIHT coders – JPEG 2000 standards – JBIG and JBIG2 standards.														
<b>UNIT 4: AUDIO COMPRESSION</b>												<b>9</b>		
Audio compression Techniques – law, A-Law compounding – Frequency domain and filtering – Basic sub-band coding – Application to speech coding – G.722 – MPEG audio – progressive encoding – Silence compression, Speech compression – Formant and CELP vocoders.														
<b>UNIT 5: VIDEO COMPRESSION</b>												<b>9</b>		
Video compression techniques and Standards – MPEG video coding: MPEG-1 and MPEG-2 video coding: MPEG-3 and MPEG-4 – Motion estimation and compensation techniques – H.261 Standard – DVI technology – DVI real time compression – Current Trends in Compression standards.														
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1: Implement basic compression algorithms familiar with the use of MATLAB and its equivalent open source environments														
CO2: Design and implement the Text compression algorithms														
CO3: Analyse different approaches of image compression algorithms in multimedia projects.														
CO4: Analyse different approaches of audio compression algorithms in multimedia projects.														
CO5: Design and implement the video compression algorithms														
<b>CO-PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2						2	2	3	3	3	
CO2	2	2	2						3	3	2	3	3	
CO3	2	3	2						2	2	2	2		2
CO4	2	2	2						2	3	2	2		3
CO5	2	3	2						2	2	2	2		2
<b>1- low, 2 – medium, 3 – high, ‘-‘ no correlation</b>														

**REFERENCE BOOKS:**

1.Cold McAnlis and AleksHaecky, “ Understanding Compression: Data Compression for Modern Developers”, O’Reilly, 2016

2.Khalid Sayood: Introduction to Data Compression”, Morgan Kauffman Harcourt India, Third Edition, 2010.

3.David Solomon, “Data Compression – The Complete Reference”, Fourth Edition, Springer Verlog, New York, 2006.

4.Mark S. Drew, Ze-Nian Li, “Fundamentals of Multimedia”, PHI, 2009.

5.Raymond Westwater and BorkoFurht,” Real-time Video Compression: Techniques and Algorithms”, Springer, 2013.

6.Yun Q.Shi, Huifang Sun, “Image and Video Compression for Multimedia Engineering, Algorithms and Fundamentals”, CRC Press, 2003.

**WEB RESOURCES:**

1.<https://www.analytixlabs.co.in/blog/data-compression-technique/>

2.<https://www.alibabacloud.com/knowledge/hot/digital-video-compression-techniques>

IT626213 - REMOTE SENSING					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>To familiarize about the basic principles of remote sensing</li> <li>To acquire knowledge about the motion of remote sensing satellites in the space</li> <li>To expose the various types of sensors used for remote sensing</li> <li>To gain knowledge about the generation of satellite data products</li> <li>To extract useful information from satellite images</li> </ul>					
<b>UNIT 1: PHYSICS OF REMOTE SENSING</b>				<b>9</b>	
Remote Sensing - Definition - Components - Electro Magnetic Spectrum – Basic wave theory – Particle theory – Stefan Boltzman law - Wiens-Displacement Law - Radiometric quantities - Effects of Atmosphere- Scattering – Different types –Absorption-Atmospheric window- Energy interaction with surface features – Spectral reflectance of vegetation, soil and water – atmospheric influence on spectral response patterns- multi concept in Remote sensing					
<b>UNIT 2: PLATFORMS</b>				<b>9</b>	
Orbit elements – Types of orbits – Motions of planets and satellites – Launch of space vehicle – Orbit perturbations and maneuvers – escape velocity - Types and characteristics of different remote sensing platforms – sun synchronous and geo synchronous satellites.					
<b>UNIT 3: SENSORS</b>				<b>9</b>	
Classification of remote sensors – selection of sensor parameters - resolution concept - Spectral, Radiometric and temporal resolution – Quality of images – imaging mode – photographic camera – opto-mechanical scanners – pushbroom and whiskbroom cameras – Panchromatic, multi spectral , thermal, hyperspectral scanners and microwave sensors – geometric characteristics of scanner imagery – Operational Earth resource satellites - Landsat, SPOT, IRS, WorldView, hyperion and hysis, ERS, ENVISAT, Sentinel.					
<b>UNIT 4: DATA RECEPTION AND DATA PRODUCTS</b>				<b>9</b>	
Ground segment organization – Data product generation – sources of errors in received data – referencing scheme – data product output medium – Digital products – Super structure, Fast,GeoTIFF, Hierarchical and HDF formats – Indian and International Satellite Data Products – ordering of data					
<b>UNIT 5: DATA ANALYSIS</b>				<b>9</b>	
Data products and their characteristics – Elements of visual interpretation – interpretation keys – Digital image processing – Preprocessing – Image rectification – Image enhancement techniques– Image classification – Supervised and unsupervised classification algorithms for multispectral and hyperspectral images – Accuracy assessment.- hybrid classification techniques – Knowledge based classification, Neural Network Classification, Fuzzy Classification.					
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1: Know the concepts and laws related to remote sensing					
CO2: Acquire knowledge about various remote sensing platforms					
CO3: Acquire the knowledge of the characteristics of different types of remote sensors					
CO4: Apply the knowledge about reception, product generation, storage and ordering of satellite data.					
CO5: Design the basic concept of different image processing techniques and interpretation of satellite data					

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2	2	3	2	
CO2	2	2	2						2	3	2	3	3	
CO3	2	2	2						3	2	3	2	2	
CO4	2	2	2						2	2	2	2		3
CO5	2	3	2						3	2	2	2		2

**1- low, 2 - medium, 3 - high, '-' no correlation**

**REFERENCE BOOKS:**

1.Thomas Lillesand, R.W.Kiefer and Jonathan Chipman, "Remote Sensing and Image interpretation", Wiley, Seventh edition, 2015.

2.John R. Jensen,"Introductory Digital Image Processing: A Remote Sensing Perspective", Pearson Education, 4th Edition, 2016.

4.Paul J. Curran. "Principles of Remote Sensing", Longman Scientific & Technical, 1986.

5.George Joseph, C.Jeganathan, "Fundamentals of Remote Sensing", Third Edition, Universities Press (India) Pvt Ltd, Hyderabad, 2018.

6.S. C. Bhatia,"Fundamentals of Remote Sensing", Atlantic Publishers & Distributors (P) Limited,2008.

**WEB RESOURCES:**

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

2. <http://rsl.gis.umn.edu/rs101.html>

IT626214 - GRID COMPUTING														
Course Category: Programme Elective	Course Type: Theory			L	T	P	C							
				3	0	0	3							
<b>COURSE OBJECTIVES:</b>														
<ul style="list-style-type: none"> <li>To learn the basics of grid computing</li> <li>To know the grid computing initiatives</li> <li>To learn the application of grid computing</li> <li>To know the features of the Grid computing technology</li> <li>To understand the tool kits to facilitated the grid computing</li> </ul>														
<b>UNIT 1: GRID COMPUTING</b>													<b>9</b>	
Introduction - Definition and Scope of grid computing														
<b>UNIT 2: GRID COMPUTING INITIALIVES</b>													<b>9</b>	
Grid Computing Organizations and their roles – Grid Computing analog – Grid Computing road map.														
<b>UNIT 3: GRID COMPUTING APPLICATIONS</b>													<b>9</b>	
Merging the Grid sources – Architecture with the Web Devices Architecture.														
<b>UNIT 4: TECHNOLOGIES</b>													<b>9</b>	
Acting under Uncertainty, Basic Probability Notation, Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation of Conditional Distributions, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks, Extending Probability to First-Order Representations, Other Approaches to Uncertain Reasoning.														
<b>UNIT 5: GRID COMPUTING TOOL KITS</b>													<b>9</b>	
Inductive learning for classification, decision-tree induction, neural-networks: representation and training.														
<b>TOTAL: 45 PERIODS</b>														
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to														
CO1: Acquire the knowledge of the basics of grid computing														
CO2: Know the features of the grid computing initiatives														
CO3: Know the application of grid computing														
CO4: Apply the Grid computing technology														
CO5: Develop the tool kits to facilitated the grid computing														
<b>CO-PO MAPPING</b>														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2									3	2	
CO2	2	2	2									3	3	
CO3	2	2	2									2	2	
CO4	2	2	2									2		3
CO5	2	3	2									2		2
<b>1- low, 2 - medium, 3 - high, '-' no correlation</b>														
<b>REFERENCE BOOKS:</b>														
1.Joshy Joseph & Craig Fellenstein, “Grid Computing”, Pearson Education, 2004.														
2.Ahmar Abbas, “Grid Computing: A Practical Guide to technology and Applications”, Charles River media – 2004.														
3.Barry Wilkinson,” Grid Computing Techniques and Applications,” Taylor and Francis, 2010.														
4.HaiZhuge,”Grid and Cooperative Computing”, Springer,2005.														
5.Frederic Magoules,”Fundamentals of Grid Computing- Theory, Algorithms and														

Technologies”, CRC Press, 2019.

6.Lizhe Wang, Wei Jie, Jinjun Chen,” Grid Computing- Infrastructure, Service, and Applications”, CRC Press,2018.

**WEB RESOURCES:**

1. <https://www.spiceworks.com/tech/cloud/articles/what-is-grid-computing/>

2. <https://www.geeksforgeeks.org/grid-computing/>

IT626215 - WEB MINING					
Course Category: Programme Elective	Course Type: Theory	L	T	P	C
		3	0	0	3
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To define the web mining and understand the need for web mining</li> <li>• To know the features of supervised and unsupervised algorithm</li> <li>• To learn the methods of information retrieval and web search algorithm</li> <li>• To know the different application areas for web mining</li> <li>• To learn the methods of Web usage mining</li> </ul>					
<b>UNIT 1: INTRODUCTION</b>					<b>9</b>
Web Data Mining and Data Mining Foundations, Introduction – World Wide Web (WWW), A Brief History of the Web and the Internet, Web Data Mining-Data Mining, Web Mining. Data Mining Foundations – Association Rules and Sequential Patterns – Basic Concepts of Association Rules, Apriori Algorithm- Frequent Itemset Generation, Association Rule Generation, Data Formats for Association Rule Mining, Mining with multiple minimum supports – Extended Model, Mining Algorithm, Rule Generation, Mining Class Association Rules, Basic Concepts of Sequential Patterns, Mining Sequential Patterns on GSP, Mining Sequential Patterns on PrefixSpan, Generating Rules from Sequential Patterns.					
<b>UNIT 2: SUPERVISED AND UNSUPERVISED LEARNING</b>					<b>9</b>
Supervised Learning – Basic Concepts, Decision Tree Induction – Learning Algorithm, Impurity Function, Handling of Continuous Attributes, Classifier Evaluation, Rule Induction – Sequential Covering, Rule Learning, Classification Based on Associations, Naïve Bayesian Classification , Naïve Bayesian Text Classification – Probabilistic Framework, Naïve Bayesian Model . Unsupervised Learning – Basic Concepts , K-means Clustering – K-means Algorithm, Representation of Clusters, Hierarchical Clustering – Single link method, Complete link Method, Average link method, Strength and Weakness.					
<b>UNIT 3: INFORMATION RETRIEVAL AND WEB SEARCH</b>					<b>9</b>
Basic Concepts of Information Retrieval, Information Retrieval Methods – Boolean Model, Vector Space Model and Statistical Language Model, Relevance Feedback, Evaluation Measures, Text and Web Page Preprocessing – Stopword Removal, Stemming, Web Page Preprocessing, DuplicateDetection, Inverted Index and Its Compression – Inverted Index, Search using Inverted Index, Index Construction, Index Compression, Latent Semantic Indexing – Singular Value Decomposition, Query and Retrieval, Web Search, Meta Search, Web Spamming.					
<b>UNIT 4: LINK ANALYSIS AND WEB CRAWLING</b>					<b>9</b>
Link Analysis – Social Network Analysis, Co-Citation and Bibliographic Coupling, Page Rank Algorithm, HITS Algorithm, Community Discovery-Problem Definition, Bipartite Core Communities, Maximum Flow Communities, Email Communities. Web Crawling – A Basic Crawler Algorithm- Breadth First Crawlers, Preferential Crawlers, Implementation Issues – Fetching, Parsing, Stopword Removal, Link Extraction, Spider Traps, Page Repository, Universal Crawlers, Focused Crawlers, Topical Crawlers, Crawler Ethics and Conflicts.					
<b>UNIT 5: OPINION AND WEB USAGE MINING</b>					<b>9</b>
Opinion Mining and Opinion Mining – Sentiment Classification – Classification based on Sentiment Phrases, Classification Using Text Classification Methods, Feature based Opinion Mining and Summarization – Problem Definition, Object feature extraction, Feature Extraction from Pros and Cons of Format1, Feature Extraction from Reviews of Format 2 and 3, Comparative Sentence and Relation Mining, Opinion Search and Opinion Spam. Web Usage Mining – Data Collection and Preprocessing- Sources and Types of Data, Key Elements of Web usage Data Preprocessing, Data Modeling for Web Usage Mining,					



Discovery and Analysis of Web usage Patterns -Session and Visitor Analysis, Cluster Analysis and Visitor Segmentation, Association and Correlation Analysis, Analysis of Sequential and Navigation Patterns.

**TOTAL: 45 PERIODS**

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

CO1: Describe web mining and understand the need for web mining

CO2: Apply the features of supervised and unsupervised algorithm

CO3: Apply the methods of information retrieval and web search algorithm

CO4: Develop the different application areas for web mining

CO5: Design the methods of Web usage mining

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2						2	2	2	3	2	
CO2	2	2	2						2	2	2	3	3	
CO3	2	2	2						3	2	3	2		3
CO4	2	2	2						3	2	3	2		3
CO5	2	3	2						2	2	2	2		2

**1- low, 2 - medium, 3 - high, '-' no correlation**

**REFERENCE BOOKS:**

1. Bing Liu, "Web Data Mining: Exploring Hyperlinks, Contents, and Usage Data", Springer Publications, Second Edition,2013.

2. Jiawei Han, MichelineKamber,"Data Mining: Concepts and Techniques", Elsevier Publications, Fourth Edition, 2022

3.Anthony Scime,"Web Mining:: Applications and Techniques", Idea Group Publishing,2005

4.SoumenChakrabarti,"Mining the Web: Discovering Knowledge from Hypertext Data", Elsevier Publications, Second Edition,2002

5.Hsinchun Chen, "Dark Web-Exploring and Data Mining the Dark Side of the Web,2011

6.Zdravko Markov, Daniel T. Larose, Data Mining the WebUncovering Patterns in Web Content, Structure, and Usage,2007

**WEB RESOURCES:**

1. <https://www.javatpoint.com/web-content-vs-web-structure-vs-web-usage-mining>

2. <https://www.geeksforgeeks.org/web-mining/>

IT626216 - SOFTWARE QUALITY ASSURANCE					
<b>Course Category: Programme Elective</b>	<b>Course Type: Theory</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
		<b>3</b>	<b>0</b>	<b>0</b>	<b>3</b>
<b>COURSE OBJECTIVES:</b>					
<ul style="list-style-type: none"> <li>• To be exposed to the Software Quality Assurance (SQA) architecture and the details of SQA components.</li> <li>• To understand of how the SQA components can be integrated into the project life cycle.</li> <li>• To be familiar with the software quality infrastructure.</li> <li>• To be exposed to the management components of software quality.</li> <li>• To be familiar with the software quality Standards, Certification and Assessments</li> </ul>					
<b>UNIT 1: INTRODUCTION TO SOFTWARE QUALITY &amp; ARCHITECTURE</b>				<b>9</b>	
Need for Software quality – Quality challenges – Software quality assurance (SQA) – Definition and objectives – Software quality factors- McCall's quality model – SQA system and architecture – Software Project life cycle Components – Pre project quality components – Development and quality plans.					
<b>UNIT 2: SQA COMPONENTS AND PROJECT LIFE CYCLE</b>				<b>9</b>	
Software Development methodologies – Quality assurance activities in the development process- Verification & Validation – Reviews – Software Testing – Software Testing implementations – Quality of software maintenance – Pre-Maintenance of software quality components – Quality assurance tools – CASE tools for software quality – Software maintenance quality – Project Management.					
<b>UNIT 3: SOFTWARE QUALITY INFRASTRUCTURE</b>				<b>9</b>	
Procedures and work instructions - Templates - Checklists – 3S development - Staff training and certification Corrective and preventive actions – Configuration management – Software change control – Configuration management audit -Documentation control – Storage and retrieval.					
<b>UNIT 4: SOFTWARE QUALITY MANAGEMENT &amp; METRICS</b>				<b>9</b>	
Project process control – Computerized tools - Software quality metrics – Objectives of quality measurement – Process metrics – Product metrics – Implementation – Limitations of software metrics – Cost of software quality – Classical quality cost model – Extended model – Application of Cost model.					
<b>UNIT 5: STANDARDS, CERTIFICATIONS &amp; ASSESSMENTS</b>				<b>9</b>	
Quality management standards – ISO 9001 and ISO 9000-3 – capability Maturity Models – CMM and CMMI assessment methodologies - Bootstrap methodology – SPICE Project – SQA project process standards – IEEE st 1012 & 1028 – Organization of Quality Assurance – Department management responsibilities – Project management responsibilities – SQA units and other actors in SQA systems.					
<b>TOTAL: 45 PERIODS</b>					
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to					
CO1: Describe the basic tenets of software quality and quality factors.					
CO2: Utilize the concepts in software development life cycle.					
CO3: Demonstrate their capability to adopt quality standards					
CO4: Assess the quality of software product.					
CO5: Apply the concepts in preparing the quality plan & documents.					

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2							2		3	3	
CO2	2	2	2							3	2	3	3	
CO3	2	3	2							2	2	2		2
CO4	2	2	2									2		3
CO5	2	3	2							2		2		2

**1- low, 2 - medium, 3 - high, '-' no correlation**

**REFERENCE BOOKS:**

1. Daniel Galin, "Software Quality Assurance - From Theory to Implementation", Pearson Education Ltd UK, 2009.

2. Milind Limaye, "Software Quality Assurance", TMH, New Delhi, 2011.

3. Daniel Galin, "Software Quality : Concepts and practice", IEEE/Wiley Publication, 2018.

4. Alan C. Gillies, "Software Quality: Theory and Management", International Thomson Computer Press, 2011.

5. Mordechai Ben-Menachem, "Software Quality: Producing Practical Consistent Software", International Thompson Computer Press, 2014.

6. Kshirasagar Naik, Priyadarshi Tripathy, "Software Testing and Quality Assurance: Theory and Practice", Wiley, 2008.

**WEB RESOURCES:**

1. <https://www5.aptest.com/resources.html>

2. <https://www.geeksforgeeks.org/top-10-resources-to-learn-software-testing-in-2021/>

# **INSTITUTE ELECTIVE**

<b>IT626901: MODERN SENSOR TECHNOLOGY</b>						
Course Category: Institute Elective	Course Type: Theory	L	T	P	C	
		3	0	0	3	
<b>COURSE OBJECTIVES:</b>						
<ul style="list-style-type: none"> <li>To impart the fundamentals of sensor technology and its significance in industrial applications.</li> <li>To provide in depth knowledge in different types of Sensors.</li> <li>To implement the sensors for monitoring of Industrial Equipment.</li> <li>To provide knowledge in measuring various physical variables during industrial and scientific activities.</li> <li>To impart understanding of intelligent sensors, micro-sensors and Nano-sensors</li> </ul>						
<b>UNIT 1: CHARACTERISTICS OF SENSORS</b>						<b>9</b>
Introduction to Instrument and their representation – Static performance characteristics of instruments – Dynamic characteristics of instruments – Transducer elements – Intermediate elements – Indicating, Recording and display elements						
<b>UNIT-2 : MEASUREMENT OF MECHANICAL COMPONENTS</b>						<b>9</b>
Motion and vibration measurements – Relative, absolute type vibration measurement devices - Dimensional metrology – Mechanical, Electromechanical, Pneumatic, Hydraulic dimensional gauging devices - Force measurement - Balance principle of force measurement – Hydraulic load cell – Pneumatic load cell – Elastic force devices – Electromechanical methods – Torque and power measurements – Transmission, Torsion, Driving, Absorption type dynamometer						
<b>UNIT-3 : SENSORS FOR EQUIPMENT MONITORING</b>						<b>9</b>
Pressure measurement – Moderate pressure measurement – High pressure Bridgeman Gauge – Low pressure measurement – Calibration of pressure gauges – Temperature measurement – Measurement of temperature – Non electrical methods of Temperature Measurement – Electrical Methods of Temperature measurement – Radiation Methods – Flow measurement – Acoustics measurement.						
<b>UNIT-4 : SENSORS FOR CONDITION MONITORING</b>						<b>9</b>
Vibration and Noise monitoring – Temperature monitoring – Wear behavior monitoring – Corrosion monitoring – Material defect monitoring - Acoustic emission monitoring technique – Performance trend monitoring – Selection of condition monitoring techniques – Expert system technique in fault diagnostics.						
<b>UNIT-5 : ADVANCEMENT IN SENSING TECHNOLOGY</b>						<b>9</b>
Specific gravity measurements – Measurements of liquid level – Viscosity – Humidity and Moisture – pH value – Biomedical measurements – Environmental air pollution measurement devices - Smoke density measurement – Fibre optic Transducers – Microsensors – Smart Sensors – Virtual Instrumentation						
<b>TOTAL: 45 PERIODS</b>						
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to						
CO1: Get the knowledge of various elements in sensor measurement.						
CO2: Learn about the various sensors for motion, vibration, force and power						
CO3: Familiarize with pressure, temperature and flow measurements						
CO4: Find innovative solutions in monitoring physical parameters during on-line and off-line conditions.						
CO5: Analyse the fundamental principles of advancement in sensor technology.						

<b>CO-PO MAPPING</b>														
	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO1	2	2	2		2	-	-	-	-	2	-	2	2	-
CO2	2	2	2		2	-	-	-	-	2	-	2	2	-
CO3	2	2			2	-	-	-	-	2	-	2	-	2
CO4	2	2			2	-	-	-	-	2	-	2	-	2
CO5	2	2	2		2	-	-	-	-	2		2	-	2
1 - low, 2 - medium, 3 - high, '-' no correlation														
<b>TEXT BOOKS:</b>														
1.Nakra B.C. and Chaudhry K.K., “Instrumentation, Measurement and Analysis”, Tata Mc Graw Hill, 4th Edition, 2017.														
2.Wang L. and Gao R.X., “Condition Monitoring and Control for Intelligent Manufacturing”, Springer - Verlag London Limited, 2006.														
<b>Reference Books</b>														
1.John Vetelino, AravindReghu, “Introduction to Sensors”, CRC Press, 2017														
2.Sinclair I.R., “Sensors and Transducers”, Elsevier India Private Limited, 2001.														
<b>WEB RESOURCES:</b>														
1. <a href="https://www.techbriefs.com/component/content/article/tb/pub/features/articles/33212">https://www.techbriefs.com/component/content/article/tb/pub/features/articles/33212</a>														
2. <a href="https://www.hindawi.com/journals/js/2021/1527467/">https://www.hindawi.com/journals/js/2021/1527467/</a>														

<b>IT626902: DECISION SUPPORT AND INTELLIGENT SYSTEMS</b>						
Course Category: Institute Elective	Course Type: Theory	L	T	P	C	
		3	0	0	3	
<b>COURSE OBJECTIVES:</b>						
<ul style="list-style-type: none"> <li>To review and clarify the fundamental terms, concepts associated with Decision Support Systems.</li> <li>To discuss the modelling and analysis of the Decision Support Systems.</li> <li>To understand the enterprise DSS and knowledge management.</li> <li>To understand the intelligent systems used in DSS.</li> <li>To discuss organizational and social implications of Decision Support Systems</li> </ul>						
<b>UNIT 1:DECISION MAKING AND COMPUTERIZED SUPPORT</b>						<b>9</b>
Decision Making: Introduction and Definitions - Managers and Decision Making - Managerial decision making and Information Systems - Managers and computerized support Need - framework for decision support – concept of decision support systems (DSS) – executive support systems - preview of the modeling process-phases of decision making process.						
<b>UNIT 2 : MODELING AND ANALYSIS</b>						<b>9</b>
DSS components- DSS classifications - Data warehousing, access, analysis, mining and visualization - modeling and analysis- Static and dynamic models – influence diagrams – Optimization via mathematical programming – Heuristic programming – simulation – multidimensional modeling – model base management.						
<b>UNIT 3 : ENTERPRISE DECISION SUPPORT SYSTEMS</b>						<b>9</b>
Group decision making – Group support systems- Technologies – Creativity and Idea generation - enterprise information systems (EIS) – Comparing and Integrating EIS and DSS - supply and value chain and DSS- supply chain problems and solutions – Computerized systems - knowledge management methods, technologies and tools.						
<b>UNIT 4 : INTELLIGENT SYSTEMS</b>						<b>9</b>
Artificial intelligence (AI) – Concepts and Definitions – AI versus natural intelligence - expert systems-concepts, structure, types and benefits and problems – knowledge Engineering - knowledge acquisition and validation - knowledge representation – Techniques – Inference techniques.						
<b>UNIT 5 : IMPLEMENTATION, INTEGRATION, AND IMPACTS</b>						<b>9</b>
Implementation – Major issues of implementation – implementation strategies – Models of integration – Intelligent DSS – Intelligent modelling and model management – problems and issues in integration - impact of management support systems - overview – personnel management issues – impact of Individuals – Impacts on productivity, quality and competitiveness – Issues of legality, privacy and ethics – Other societal impacts.						
TOTAL: 45 PERIODS						
<b>COURSE OUTCOMES:</b> At the end of the course, the student will be able to						
CO1: Demonstrate an understanding of the theory of decisions and decision analysis						
CO2: Demonstrate the different models used in the DSS						
CO3: Design an information system using emerging tools and technologies for a given business problem.						
CO4: Describe the role of expert systems.						
CO5: Illustrate the implementation, integration and impacts of Decision Support Systems						

**CO-PO MAPPING**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	2	-	-	-	-	-	-	2	-	-
CO2	2	2	-	-	2	-	-	-	-	-	-	2	-	-
CO3	2	2	2	-	-	-	-	-	-	-	-	2	-	-
CO4	2	2	-	-	2	-	-	-	-	-	-	2	-	-
CO5	2	2	2	2	2	-	-	-	-	-	-	2	-	-

1- low, 2 - medium, 3 - high, '-' no correlation

**TEXT BOOKS:**

1.Efraim Turban and Jay E Aronson, "Decision Support and Intelligent Systems", Prentice Hall, 9thEdition, 2010.

2.Elain Rich, Kevin Knight and Shivashankar B. Nair , "Artificial intelligence", Tata McGraw-Hill Publishing Company Limited, 3rd Edition, 2009.

**Reference Books:**

1.Daniel J. Power, "Decision Support Systems: Concepts and Resources for Managers", Greenwood Publishing Group, 1st Edition, 2002.

2.Quazi Khabeer, "Business Process Management and Decision Support Systems", Alpha Science International Limited, 1stEdition, 2013.

**WEB RESOURCES:**

1.[https://www.researchgate.net/publication/277703502\\_Intelligent\\_Decision\\_Support\\_Systems](https://www.researchgate.net/publication/277703502_Intelligent_Decision_Support_Systems)

2.<https://www.intechopen.com/chapters/10951>