SYLLABUS FOR B.E. V &VI SEMESTER

(With effect from 2017 - 18 Academic year)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕವರ್ಷ 2017–18)

BACHELOR DEGREE

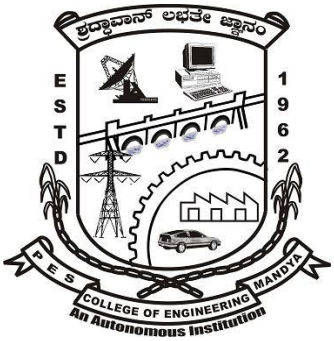
IN

COMPUTER SCIENCE & ENGINEERING

OUT COME BASED EDUCATION

WITH

CHOICE BASED CREDIT SYSTEM



P.E.S. COLLEGE OF ENGINEERING,

MANDYA - 571 401, KARNATAKA

(An Autonomous Institution Affiliated to VTU, Belagavi)

Grant -in- Aid Institution (Government of Karnataka)

Accredited by NBA, New Delhi & Approved by AICTE, New Delhi.

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ

ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ

(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)

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PREFACE

PES College of Engineering, Mandya, started in the year 1962, has become autonomous institute in the academic year 2008-09. Since, then it has been doing the academics and assessment activities successfully. The college is running eight undergraduate and eight Postgraduate programs including MBA and MCA which are affiliated to VTU, Belagavi.

India has recently become a Permanent Member of the Washington Accord. The accord was signed by the National Board of Accreditation (NBA) on behalf of India on 13th June 2014. It enables not only the mobility of our degree globally but also establishes equivalence to our degrees with that of the member nations. The implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the various countries.

Our Higher Educational Institution has adopted the Choice Based Credit System (CBCS) based semester structure with OBE scheme and grading system. Which provides the flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. There lies a shift in thinking, teaching and learning process moving towards Students Centric from Teachers Centric education which enhances the knowledge, skills & moral values of each student.

Choice Based Credit System (CBCS) provides the options for the students to select from the number of prescribed courses. The CBCS provides a 'cafeteria' type approach in which the students can Choose electives from a wide range of courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, adopt an interdisciplinary approach for learning which enables integration of concepts, theories, techniques. These are greatly enhances the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills, self learning components and Personality Development modules have been added to the existing curriculum. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are made mandatory for all undergraduate programs.

Dr.Umesh D.R.
Deputy Dean (Academic)
Associate Professor,
Dept. of Computer Science &Engg.

Dr.Nagarathna
Dean (Academic)
Professor,
Dept. of Computer Science &Engg.

P.E.S. College of Engineering, Mandya

VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals

MISSION

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.
- Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.
- Promote research, product development and industry-institution interaction.

Department of Computer Science and Engineering

The Vision of the department is:
"The Department of Computer Science and Engineering shall create professionally competent and socially responsible engineers capable of working in global environment.*"*

The mission of the department is:
DM1: Enforce best practices in teaching-learning, with dedicated faculty and supportive infrastructure to impart the knowledge in emerging technologies.
{Required to create professionally competent engineers}
DM2: Improve Industry-Institute relationship for mutual benefit.
{Required to create professionally competent engineers}
DM3: Inculcate ethical values, communication and entrepreneurial skills.
{Required to create professionally competent and socially responsible engineers}
DM4: Sensitize social, legal, environmental and cultural diversity issues through professional training and balanced curriculum.
{Required to create engineers capable of working in global environment}

Program Educational Objectives (PEOs)

Graduates of the program shall
1. Have Successful computer professional career in IT industry and related areas.
2. Pursue higher education in engineering or management with the focus on intensive research and developmental activities.
3. Develop computing systems in a responsible, professional and ethical manner to serve the society**.**

The National Board of Accreditation (NBA) has defined twelve Program Outcomes for Under Graduate (UG) engineering programs as listed below.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization for the solution of complex engineering problem.
2. **Problem analysis**: Identify, formulate, research literature, and analyse 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 public health and safety, and 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 modelling to complex engineering activities, with an understanding 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.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with the 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.
11. **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.
12. **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.

The Under Graduate (UG) of B.E Computer Science & Engineering Program has defined **Program Specific Outcomes (PSO**) which are listed below.

The students shall have the

1. Ability to design and develop network based systems in emerging technology environments like Cloud Computing, Security, Internet of Things and embedded systems.
2. Ability to develop knowledge based data management system in the areas like data analytics, data mining, business intelligence, pattern recognition and knowledge discovery in solving engineering problems.

PES COLLEGE OF ENGINEERING, MANDYA

Department of Computer Science & Engineering

Scheme of Teaching and Examination for B.E.

V Semester B.E. (CS & E)

Sl. No	Course code	Course Title	Teaching Dept.	Hrs/Week L :T: P:H	Total Credit	Examination Marks CIE	SEE	Total
1	P17CS51	Operating System	CS	4:0:0:4	4	50	50	100
2	P17CS52	Database Management Systems	CS	4:0:0:4	4	50	50	100
3	P17CS53	Computer Networks	CS	4:0:0:4	4	50	50	100
4	P17CS54	Software Engineering (Foundation course-I)	CS	4:0:0:4	4	50	50	100
5	P17CS55	Foundation Elective	CS	4:0:0:4	3	50	50	100
6	P17CS56	Elective-I	CS	4:0:0:4	3	50	50	100
7	P17CSL57	Microprocessor Lab	CS	0:0:3:3	1.5	50	50	100
8	P17CSL58	DBMS Lab	CS	0:0:3:3	1.5	50	50	100
9	P17CS59	Industry Visit & Interaction	CS	0:0:2:2	1	50	--	50
10	P17HU510	Aptitude and Reasoning Development – ADVANCED (ARDA)	HS&M	2:0:2:2	1	50	50	100
				Total	**27**	**500**	**450**	**950**

List of Electives				
Foundation Elective			**Elective-1**	
Sl.No.	Course code	Course Title	Course code	Course Title
1	P17CS551	System Simulation & Modeling	P17CS561	Digital Image processing
2	P17CS552	Web Technologies	P17CS562	JAVA & J2EE
3	P17CS553	Machine Learning Techniques and Data Science	P17CS563	Storage Area Networks
4	P17CS554	Computer Graphics & Visualization	P17CS564	Artificial Intelligence

VI Semester B.E. (CS & E)

Sl. No	Course code	Course Title	Teaching Dept.	Hrs/Week L :T: P:H	Total Credit	Examination Marks CIE	SEE	Total
1	P17CS61	Entrepreneurship Management & IPR	CS	4:0:0:4	4	50	50	100
2	P17CS62	Computer Architecture	CS	4:0:0:4	4	50	50	100
3	P17CS63	Compiler Design	CS	4:0:0:4	4	50	50	100
4	P17CS64	Data Mining & Warehousing (FC-II)	CS	4:0:0:4	4	50	50	100
5	P17CS65	Elective-II	CS	4:0:0:4	3	50	50	100
6	P17CS66	Elective-III	CS	4:0:0:4	3	50	50	100
7	P17CSL67	Networks Lab	CS	0:0:3:3	1.5	50	50	100
8	P17CSL68	Operating System & Compiler Design Lab	CS	0:0:3:3	1.5	50	50	100
9	P17CS69	Mini Project	CS	0:0:2:2	1	50	--	50
10	P17HU610	Aptitude and Reasoning Development – EXPERT (ARDE)	HS&M	0:0:2:2	1	50	50	100
				Total	27	500	450	950

List of Electives				
Elective-II			Elective-III	
Sl.No.	Course code	Course Title	Course code	Course Title
1	P17CS651	Client Server Programming	P17CS661	Wireless Networks and Mobile Computing
2	P17CS652	Soft Computing Technique	P17CS662	Semantic Web Technologies
3	P17CS653	Pattern Recognition	P17CS663	Service Oriented Architecture
4	P17CS654	Software Agents	P17CS664	Internet of Things

Course Title : Operating System			
Course Code: P17CS51	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives:

1. **Explain** operating system structure, services and **determine** the interfaces between OS and other components of a computer system.
2. **Illustrate** the main principles and techniques used to implement processes and threads as well as the different algorithms for process scheduling.
3. **Analyse** the main problems related to concurrency and the different synchronization mechanisms.
4. **Describe** different approaches of memory management and **Apply** different page replacement algorithms to resolve page faults.
5. **Describe** the structure and organization of file system, **analyse** the data storage in secondary storage and **understand** the protection issues in computer systems.

Course content

Unit – 1

Introduction to operating systems, Overview: Need of operating systems, Computer System architecture, Operating System operations, Process management, Memory management, Storage management, Protection and security, Distributed system, computing environments.
System structure: Operating System Services, User- Operating System interface, System calls, Types of system calls, System programs, Operating System structure, Virtual machines, System boot.
Self-study component: Computer System organisation, Operating System design and implementation.

10 Hours

Unit – 2

Process management, Process concepts: Overview, Process scheduling, operations on processes, Inter-process communication.
Multi-Threaded Programming: Overview, Multi-threading models, Thread Libraries,.
Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling, thread scheduling.
Self-study component: threading issues.

11 Hours

Unit – 3

Process synchronization, Synchronization: Background, The Critical section problem, Peterson's solution, Synchronization hardware, Semaphores, Classical problems of synchronization, Monitors
Deadlocks: Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock.
Self-study component: Real time CPU scheduling.

10 Hours

Unit – 4

Memory management and protection, Memory Management Strategies: Background, Swapping, Contiguous memory allocation, Paging, Structure of page table, Segmentation.

Virtual Memory Management: Background, Demand paging, Copy-on-write, Page replacement, Allocation of frames.
Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights.
Self-study component: Thrashing.

10 Hours

Unit – 5

Storage management and case study, File system: File concept, Access methods, Directory structure, File system mounting, File sharing, Protection.
Implementing File System: File system structure, File system implementation, Directory implementation, Allocation methods, Free space management. Secondary **storage structures:** Mass storage structures, Disk structure, Disk attachment, Disk scheduling, Disk management.
Case Study - Linux System: Design Principles, kernel modules, Process management, Scheduling, Memory Management, File System.
Self-study component: Swap space management.

11 Hours

Text Book:

1. Operating System Principles – Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, 9th edition, Wiley-India, 2012.

Reference Books:

1. Operating Systems: A Concept Based Approach– D.M Dhamdhere, 2nd Edition, Tata McGraw- Hill, 2006.
2. Operating Systems– William Stallings, 6th Edition, PHI, 2009.
3. Operating Systems– Harvey M Deital, 3rd Edition, AddisonWesley, 1990

Course outcomes

1. **Distinguish** between the different types of operating system environments.
2. **Apply** the concepts of process scheduling.
3. **Develop** solutions to process synchronization problems.
4. **Analyze** various memory management techniques.
5. **Identify** various issues of Linux Operating System.

Course Articulation Matrix (CAM)

		Course code : P17CS51					Title : Operating System								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO501.1	**Distinguish** between the different types of operating system environments.	1	3	-	-	-	-	-	-	-	-	-	-	2	-
CO501.2	**Apply** the concepts of process scheduling.	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO501.3	**Develop** solutions to process synchronization problems.	2	3	3	-	-	-	-	-	-	-	-	-	2	-
CO501.4	**Analyze** various memory management techniques.	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO501.5	**Identify** various issues of Linux Operating System.	2	3	-	-	-	-	-	-	-	-	-	-	2	-
		2	**2.6**	**3**										**2**	

Course Title : Database Management System			
Course Code: P17CS52	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

This course aims to

1. **S**tate the importance of DBMS and explain how DBMS is better than traditional File Processing Systems.
2. Analyze the basic structure of database and recognize the different views of the database.
3. Identify attributes, entities and relationship of the given system and draw Entity Relationship Diagrams.
4. Analyze and use Relational Data Model, while comparing with other data models.
5. Formulate data retrieval queries in SQL and the Relational Algebra and Calculus.
6. Apply normalization steps in database design using the design guidelines and functional dependencies
7. Understand and explain the terms like Transaction Processing and Concurrency Control. Understand types of database failure and recovery

Course content

Unit-1

Introduction : An example: Characteristics of Database approach; Advantages of using DBMS approach; A brief history of database applications; Data models, schemas and instances; Three-schema architecture and data independence; Database languages and interfaces; The database system environment**.** Introduction to structured, semi structured and unstructured data.

Entity-relationship model: Using High-Level Conceptual Data Models for Database Design; An Example Database Application; Entity Types, Entity Sets, Attributes and Keys; Relationship types, Relationship Sets, Roles and Structural Constraints; Weak Entity Types; Refining the ER Design; ER Diagrams.

Self-study component: Naming Conventions and Design Issues; Relationship types of degree higher than two.

10 Hours

Unit-2

Relational model and relational algebra: Relational Model Concepts; Relational Model Constraints and Relational Database Schemas; Update Operations, Transactions and dealing with constraint violations; Unary Relational Operations: SELECT and PROJECT; Relational Algebra Operations from Set Theory; Binary Relational Operations: Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER-to-Relational Mapping.

Self-study component: Binary Relational Operations: JOIN and DIVISION.

10 Hours

Unit-3

Structured query language : SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval Queries in SQL, INSERT, More complex SQL Retrieval Queries, Specifying constraints as Assertion and Actions as Trigger; Views(Virtual Tables) in SQL; Additional features of SQL; Schema Change Statements in SQL.

Self-study component: DELETE, and UPDATE Statements in SQL.

12 Hours

Unit-4

Database design: Informal Design Guidelines for Relation Schemas; Functional Dependencies; Normal Forms Based on Primary Keys; General Definitions of Second and Third Normal Forms; Boyce-Codd Normal Form; Multi valued Dependencies and Fourth Normal Form; Join Dependencies and Fifth Normal Form.

Self-study component: Additional features of SQL; Schema Change Statements in SQL

10 Hours

Unit– 5

Transaction processing concepts: Introduction to Transaction processing; Transactions and System concepts; Desirable properties of transactions; Characterizing Schedules based on Serializability. Concurrency control based on timestamp ordering**;**

Distributed data bases: Distributed data base concepts, Types of Distributed data base systems, Distributed data base architectures, Data fragmentation replication and allocation techniques for Distributed data base design, Query processing and optimization in Distributed data bases

Self-study component: Concurrency control: Two-phase locking techniques for concurrency control.

10 Hours

Text Books:

1. FundamentalsofDatabaseSystems–ElmasriandNavathe,6thEdition,Addison-Wesley, 2011

Reference Books:

1. **Database System Concepts**–Silberschatz, Korthand Sudharshan, 5th Edition, Mc-GrawHill, 2006.
2. **An Introduction to Database Systems**– C.J.Date, A.Kannan, S.Swamynatham, 8th Ed., Pearson Education, 2006.
3. **Database Management Systems** –Raghu Ramakrishnan and Johannes Gehrke –3rd Ed., McGraw-Hill, 2003.

Course outcomes

At the end of the course the student should be able to

1. **Design** an ER model for a given example from real world description.
2. **Design** relational models for a given application using schema definition and constraints.
3. **Develop** complex queries using SQL to retrieve the required information from database.
4. **Apply** suitable normal forms to normalize the given database
5. **Determine** the roles of concurrency control in database design.

CO-PO mapping

Course code : P17CS52			Title : Database Management System												
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO502.1	**Design** an ER model for a given example from real world description	3	3	3	1					2		2	2		3
CO502.2	**Design** relational models for a given application using schema definition and constraints.	3	2	3	1					2		2	2		3
CO502.3	**Develop** complex queries using SQL to retrieve the required information from database	3	3	3		2				2		2			3
CO502.4	**Apply** suitable normal forms to normalize the given database	2	2	2						2		2			2
CO502.5	**Determine** the roles of con-currency control in database design.	2	1	1											2
C502, C302		**2.6**	**2.2**	**2.4**	**1**	**2**				**2**			**2**	**2**	**2.6**

Course Title : Computer Networks			
Course Code: P17CS53	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

1. **Understand** and recognize the importance of network layer and its functionalities.
2. **Analyze** various routing algorithms and the need of upgrading to IPv6 protocol.
3. **Differentiate** between TCP & UDP, and understand the services provided by them like flow control, congestion control etc.
4. **Understand** and recognize the importance of application layer and the working of protocols like HTTP, FTP, DNS etc
5. **Analyze** the different types of quality of service and understand some of the factors driving the need for network and Internet security.

Course Content

Unit – 1

Network layer: Network-layer services, packet switching, network-layer performance, forwarding of IP packets.
Network-layer protocols: Internet protocol (IP), ICMPv4, mobile ip
Self-study component: IPv4 addresses

11 Hours

Unit – 2

Unicast routing: Introduction, routing algorithms, unicast routing protocols.
Multicast routing: Introduction, multicasting basics, intradomain multicast protocols, interdomain multicast protocols, IGMP.
Next generation ip: IPv6 addressing, the IPv6 protocol, the ICMPv6 protocol,
Self-study component: Transition from ipv4 to ipv6.

10 Hours

Unit – 3

Transport layer: Introduction, user datagram protocol, transmission control protocol, SCTP.
Self-study component: Transport-layer protocols

10 Hours

Unit – 4

Application layer: Introduction, client-server programming, iterative programming in c.
Standard client-server protocols: World wide web and HTTP, FTP, electronic mail, domain name system (dns).
Network management: Introduction, SNMP, asn.1.
Self-study component: Telnet, secure shell (ssh)

10 Hours

Unit – 5

Quality of service: Data-flow characteristics, flow control to improve qos, integrated services (intserv), differentiated services (dffserv).
Cryptography and network security: Introduction, confidentiality.
Internet security: Network-layer security, transport-layer security, application-layer security, firewalls.
Self-study component: Other aspects of security

11 Hours

Text Book:

1. Behrouz A. Forouzan: Data communication and Networking, 5th edition, Tata McGraw-Hill, 2012.

Reference Books:

1. Larry L. Peterson and Bruce S Davie: Computer Networks: A Systems Approach, Fifth Edition, Elsevier, 2011.
2. William Stallings: Data and Computer Communications, 8th Edition, Pearson Education, 2012.
3. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach, 6th edition, Addison-Wesley, 2009.
4. Tanenbaum: Computer Networks, 5th Ed, Pearson Education/PHI, 2011.

Course outcomes

1. **Discuss** IPv4 protocols and its functions provided at networks layer.
2. **Analyze** various routing algorithms like distance vector, link state, hierarchical & multicast routing, and understand the concept of fragmentation.
3. **Differentiate** between TCP, UDP & SCTP and understand the services provided by them like flow control, congestion control etc.
4. **Discuss** the importance of application layer and the working of protocols like HTTP, FTP, DNS etc
5. **Analyze** the different types of quality of service and understand the concept of Network & Internet security.

CO-PO Mapping

Semester: 5th	**Course code : P17CS53**						**Title : Computer Networks**								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**
C602.1	**Discuss** IPv4 protocols and its functions provided at networks layer.	3	1	1										1	1
C602.2	**Analyze** various routing algorithms like distance vector, link state, hierarchical & multicast routing, and understand the concept of fragmentation.	2	1	1										2	2
C602.3	**Differentiate** between TCP, UDP & SCTP and understand the services provided by them like flow control, congestion control etc.	2	1		1									2	3
C602.4	**Discuss** the importance of application layer and the working of protocols like HTTP, FTP, DNS etc	2	1		1									1	2
C602.5	**Analyze** the different types of quality of service and understand the concept of Network & Internet security	2		1										2	2
C602		**2.2**	**1**	**1**	**1**									**1.6**	**2**

Course Title : Software Engineering (FC-I)			
Course Code: P17CS54	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Objectives

This course aims to:

1. Introduction to Software Engineering.
2. Describe the process of Software Engineering, the technologies used for Software Engineering, and configuration management of Software Engineering.
3. Apply Architectural Design Architectural design decisions System organization Modular decomposition styles Control styles.
4. Understand what Software Testing is.
5. Explain Project management Risk management, Managing people, Teamwork, Understand Configuration management

Course content

Unit - 1

Overview: Introduction to Software Engineering, Introduction, Professional software development, Software engineering ethics, Case studies.

Software processes: Software process models, Process activities, coping with change, The Rational Unified Process.

Self-study component: Study of software engineering, development of software product and ethics.

8 Hours

Unit – 2

Agile software development: Agile methods, Plan driven and agile development, Extreme programming, Agile project management, Scaling agile methods

Requirements engineering: Functional and non-functional requirements, The software requirements document Requirements specification, Requirements engineering processes, Requirements elicitation and analysis, Requirements validation, Requirements management.

Self-study component: Study of agile software development methods and requirement engineering.

12 Hours

Unit – 3

System modelling: Context models, Interaction models, Structural odels, Behavioral models, Model-driven engineering.

Architectural design: Architectural design decisions, Architectural views, Architctural patterns, Application architectures

Self-study component: Modelling techniques and study of architectural design concepts.

12 Hours

Unit – 4

Design and Implementation: Object-oriented design using the UML Design patterns, Implementation issues, Open source development

Software testing: Development testing, Test-driven development, Release testing, user testing

Self-study component: Methods to software design, development and implementation, to study testing methods.

. **10 Hour**

Unit – 5

Project management: Risk management, Managing people, Teamwork.

Configuration management: Change management, Version management System building, Release management.

Self-study component: Risk and people management, study change version and release management

8 Hours

Text book:

1. **Software Engineering** – Ian Somerville, 10th Edition, ©*2016*| ***Pearson***.

Reference books:

1. **Software Engineering: A Practitioners Approach -** Roger S. Pressman, 7th Edition, McGraw-Hill, 2007.
2. **Software Engineering Theory and Practice -** Shari Lawrence Pfleeger, Joanne M. Atlee, 3rd Edition, Pearson Education, 2006.
3. **Software Engineering Principles and Practice –**Waman S Jawadekar, Tata McGraw Hill, 2004
4. **Software Engineering** – PankajJalote, Tata McGraw Hill.

Course Outcomes

At the end of the course the student should be able

1. **Explore** the various types of software process.
2. **Elaborate** the importance of software development.
3. **Asses** the significance of software engineering.
4. **Compare** different Software Development methods.
5. **Identify** the different forms of Software Development.

CO-PO mapping

Semester: 5th	**Course code : P17CS54**						**Title : Software Engineering(FC-I)**								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**
CO 605.1	**Explore** the various types of software process.	3	2	1	1		1	1						2	
CO 605.2	**Elaborate** the importance of software development.	3	2	2	1	2	1		1				1	2	
CO 605.3	**Asses** the significance of software engineering	2	2	2		1			1	1				2	
CO 605.4	**Compare** different Software Development methods.	2	2	3	1			1		1				2	
CO 605.5	**Identify** the different forms of Software Development.	2	1	1		1		1	1	1		1	1	2	
C605		**2.4**	**1.8**	**1.8**	**1**	**1.3**	**1**	**1**	**1**	**1**		**1**	**1**	**2**	

FOUNDATION ELECTIVES

Course Title : System Simulation & Modeling			
Course Code: P17CS551	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Objectives

1. Introduce concepts of system and simulation models.
2. Analyzing the various probability distribution functions
3. Information about determining performance measures for queuing systems
4. Develop an input model for a given system
5. Verify, Validate and perform output analysis of a simulation model

Course Content

Unit – 1

Introduction : Introduction to Simulation, Advantages and disadvantages of Simulation; Areas of application; Systems and system environment; Components of a system; Discrete and continuous systems; Model of a system; Discrete-Event System Simulation; Steps in a Simulation Study.

Self-study component: Types of Models

10 Hours

Unit – 2

Random-Number Generation: Properties of random numbers: Generation of pseudo-random numbers; Techniques for generating random numbers.

Random-Variates Generation: Inverse transform technique: Acceptance-Rejection technique.

Self-study component: Tests for Random Numbers

12 Hours

Unit – 3

Queuing Models: Characteristics of queuing systems; Queuing notation Simulation Examples: Inventory System

Self-study component: Queuing

10 Hours

Unit – 4

General Principles: Concepts in Discrete-Event Simulation: The Event-Scheduling / Time-Advance Algorithm, World Views, Manual simulation Using Event Scheduling;

Input Modeling: Data Collection; Identifying the distribution with data; Parameter estimation; Goodness of Fit Tests; Chi-Square test.

Self-study component: K-S Test

10 Hours

Unit – 5

Verification and Validation : Model building, verification and validation, Verification of simulation models; Calibration.

Output analysis: Types of simulations with respect to output analysis; stochastic nature of output data; Measures of performance and their estimation; Output analysis for terminating simulations.

Self-study component: Validation of models

10 Hours

Text Book:

1. Discrete-Event System Simulation, Jerry Banks, John S. Carson II, Barry L. Nelson, David M. Nicol, 5th Edition

Reference Book:

1. Lawrence M. Leemis, Stephen K. Park: Discrete – Event Simulation: A First Course, Pearson / Prentice-Hall, 2006.

Course Outcomes

The students will be able to

1. Develop simulation model using the engineering knowledge for a given problem.
2. Apply simulation concepts to develop simulation models.
3. Analyze methods to simulate any discrete system using queuing systems.
4. Design an input model for a given simulation system.
5. Verify, Validate and Perform output analysis of a simulation model.

CO-PO Mapping

Semester: 5	Course code : P17CS551				Title : System Simulation & Modeling										
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**
CO 605.1	Develop simulation model using the engineering knowledge for a given problem.	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 605.2	Apply simulation concepts to develop simulation models.	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO 605.3	Analyze methods to simulate any discrete system using queuing systems	2	2	3	-	-	-	-	-	-	-	-	-	-	2
CO 605.4	Design an input model for a given simulation system	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO 605.5	Verify, Validate and Perform output analysis of a simulation model	2	2	2	-	-	-	-	-	-	-	-	-	2	-

Course Title : Web Technologies			
Course Code: P17CS552	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

1. This course is intended to provide an exposure to fundamental concepts of WWW, Internet, Browsers, Servers, URL, MIME, HTTP
2. To present competent technologies for the design of Web using XHTML and CSS.
3. To provide knowledge of scripting languages such as JavaScript and design Dynamic XHTML documents using DOM and JavaScript
4. To create XML documents using DTD/ XML schema and XSLT style sheets and Create cookies using PHP, Implement session tracking using PHP
5. To develop a Rails application using Ajax

Course content

Unit– 1

Fundamentals of Web: Internet, WWW, Web Browsers and Web Servers, URLs, MIME, HTTP

Introduction to XHTML: Origins and evolution of HTML and XHTML, Basic syntax, Standard XHTML document structure, Basic text markup, Images, Hypertext Links, Lists, Tables, Forms, Frames, Syntactic differences between HTML and XHTML.

Self-study component: Security, The Web Programmers Toolbox,

10 Hours

Unit- 2

CSS: Introduction, Levels of style sheets, Style specification formats, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The Box model, Background images, The and tags

JAVASCRIPT: Overview of JavaScript, Object orientation and JavaScript, General syntactic characteristics, Primitives, operations, and expressions, Screen output and keyboard input, Control statements, Object creation and modification, Arrays, Functions, Constructor, Examples.

Self-study component: Pattern matching using regular expressions in JavaScript, Errors in Javascripts

10 Hours

Unit - 3

JAVASCRIPT AND HTML DOCUMENTS: The JavaScript execution environment; The Document Object Model; Element access in JavaScript; Events and event handling; Handling events from the Body elements, Button elements, Text box and Password elements

DYNAMIC DOCUMENTS WITH JAVASCRIPT: Introduction to dynamic documents; Positioning elements; Moving elements; Element visibility; Changing colors and fonts; Dynamic content; Stacking elements; Locating the mouse cursor; Reacting to a mouse click;

Self-study component: Slow movement of elements; Dragging and dropping elements

11 Hours

Unit-4

XML: Introduction; Syntax; Document structure; Document Type definitions; Namespaces; XML schemas; Displaying raw XML documents; Displaying XML documents with CSS; XSLT style sheets; XML processors; Web services.

PHP: Origins and uses of PHP, Overview of PHP, General syntactic characteristics, Primitives, Operations and expressions, Output, Control statements, Arrays, Functions, Pattern matching, Form handling, Files,
Self-study component: Cookies, Session tracking

11 Hours

Unit-5

Introduction to Rails : Overview of Rails, Document requests, processing forms.
Introduction to Ajax : Overview of Ajax, Basics of Ajax, Rails with Ajax
Self-study component: Rails applications with databases

10 Hours

Text book:

1. **Programming the World Wide Web** – Robert W. Sebesta, 8th Edition, Pearson Education, 2015.

Reference books:

1. **Internet & World Wide Web How to program** – M. Deitel, P.J Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
2. **Web Programming Building Internet Applications** – Chris Bates, 3rd Edition, Wiley India, 2006.
3. **The Web Warrior Guide to Web Programming** – XueBai et al,

Course Outcomes

1. **Develop** web pages using various XHTML tags.
2. **Design** interactive web pages using java script.
3. **Create** dynamic documents using DOM object model.
4. **Develop** web pages using PHP scripts.
5. **Implement** a simple Rails application using Ajax.

CO-PO Mapping

Semester: 5th	**Course code : P17CS552**						**Title : Web Technologies**								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**P S 02**
CO601.1	**Develop** web pages using various XHTML tags	3	2	3										2	
CO601.2	**Design** interactive web pages using java script	2	2	2	3									2	
CO601.3	**Create** dynamic documents using DOM object model.	2	2	3										2	
CO601.4	**Develop** web pages using PHP scripts	2	2	3										2	
CO601.5	**Implement** a simple Rails application using Ajax	2	2	2	3									3	
C601		**2.2**	**2**	**2.6**	**3**									**2.2**	

Course Title : Green Computing			
Course Code: P17CS553	**Semester : 5**	**L-T-P-H: 4 : 0 : 0 : 4**	**Credits:3**
Contact Period: Lecture: 52 Hrs. Exam: 3Hrs.		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

1. To understand the need of Green Computing.
2. Evaluate the role of Cloud Computing in Green solutions.
3. Analyze Green Device Portfolio.
4. Analyze Green data centres and energy consumption.
5. To understand corporate socio economical responsibility of Green computing.

Course Content

Unit 1

Green Computing and the Environment: Environmental Drivers for Green Computing, What Drives the Green Agenda? , Key Roots of Environmentalism, Environmentalism and IT, The New Imperative of Climate Change, Al Gore and Climate Change, The 2°C Warming "Limit" , Climate Change and IT, What's Next with Climate Change? , What It Means to "Go Green", Why IT Is a Climate Change Solution, Career Development and "Going Green". **Text1:35 to 58**

Self-study component: A Brief History of the Climate

11 Hours

Unit 2

A New Vision of Computing: Cloud Computing Emerges, The End of the PC Era, Some New-Model IT Challenges, A Few Examples from a Multinational, How a Company Adopted the iPhone, A Mental Model for IT Simplicity, Why Green Computing Fits the New Model, Is Cloud Computing the Whole Answer?, Disadvantages of Cloud Computing, Managing Disadvantages of Cloud Computing, What to Do Besides Cloud Computing, Efficiency and Cloud Computing, Greenability and Cloud Computing, Responsibility, Usability, and Cloud Computing, The Zen of Green Computing.**Text1: 59 to 88**

Self-study component: The Philosophical Implications of Green Computing

10 Hours

Unit 3

Part-I Building a Green Device Portfolio: Introduction, Why Green Works for Device, Purchases, Pushing Computing Down the Device Pyramid, Another Dimension of Device, Pyramid Greenness, Green Computing and Embodied Energy, Green Computing and Running Costs, Planned Obsolescence Isn't Green, Green Computing and Device Disposal, The Greenpeace Guide to Greener Electronics, Support Employees' Device Choices, Publicizing Your Process.

Part-II Finding Green Devices : What Makes a Device Green?, What Makes a Supplier Green?, , Giving Suppliers and Vendors Feedback, Publicizing Your Selection Process and the Winner, A Sample Statement of Green Buying Principles Desktop Computers, Laptops, Sustainability and Failure to Supply, The Case of Windows 8 Tablets, "Less Computer" and "Computer-less" Solutions.**Text1:89 to 132**

Self-study component: Case Study: HP vs. Dell

11 Hours

Unit 4

Part-I Green Servers and Data Centers: Choosing and Creating Green Data Centers, Green Data Centers as a Model, The Last Shall Be First, What Makes a Data Center Green?, Building and Power Supply Considerations, Servers, Storage, and Networking.

Part-II Saving Energy: Saving Energy Serves Many Masters, Cost Savings through Energy Savings, Risk Reduction through Energy Savings, Carbon Footprint Reduction through Energy Savings, Improving Your Reputation and Brand, Why Energy Prices Will Stay High Embodied Energy, Analyzing Your Energy Usage, A Recipe for Energy Savings, Understanding the Unique Energy Needs of IT, Focusing on Solar Power, Saving Energy and Supply Chain Energy-Saving Pilot Projects, Selling Energy Savings.
Text1: 133 to 142,143 to 166)
Self-study component: Data Center Suppliers

10 Hours

Unit 5

PART-I Green Computing by Industry Segment: Evaluating Greenness, The Newsweek Green 500 Approach, Looking at Industry Segments, **(Text1: Ch.11 Pg.No.197-212).**
PART-II The Future: Deep Green Computing: Green Computing and the Future Megatrends for Green Computing, An Increasing Need for Sustainability, The Continually Decreasing Cost of Core Computing Capabilities, The Ability of Computing to Do More and More, Telepresence Instead of Travel, Telecommuting Instead of Commuting, Toward Deep Green Computing, Platforms for Deep Green Computing, Selling Deep Green Computing. **(Text1: Ch.12 Pg.No.213-232)**
Self-study component: Analyzing Your Own Initiatives, Company, and Sector

10 Hours

Text Book:

1. Green Computing: Tools and Techniques for Saving Energy, Money, and Resources, Bud E. Smith, CRC Press. ISBN: 9781466503403.

Reference Books:

1. Sustainable ICTs and Management Systems for Green Computing, Naima Kaabouch, Wen-Chen Hu, IGI Global Publishers. ISBN: 9781466618398.
2. Handbook of Green Information and Communication Systems, edited by Mohammad S. Obaidat, AlaganAnpalagan, Isaac Woungang, Academic Press. ISBN: 0124158447.

CO#	Course Outcome	Program Outcome with BTL
CO1	**Understand** the need of Green Computing and IT aspects.	**PO1, [L3]**
CO2	**Evaluate** the role of Cloud Computing in Green solutions and data centers.	**PO2, [L3]**
CO3	**Knowledge** of IT & energy, Recycling, Recovery technologies, models and future technologies with case studies.	**PO1, [L4]**
CO4	**Analyze**Green Device Portfolio, Energy saving, cost saving and risk reductionwrt IT.	**PO2, [L3]**
CO5	**Understand** IT and corporate socio economical responsibility of Green computing and environmental issues.	**PO1, [L2]**

CO-PO Mapping

CO	PO1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
#1						3							1	
#2		2											2	2
#3							3							3
#4		3											2	2
#5											3		2	

Course Title : Computer Graphics & Visualization			
Course Code: P17CS554	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course learning objectives:

Students will be able to :

1. Learn the basics of Application Programming Interface (API) implementation based on graphics pipeline approach.
2. Apply mathematical transformations and vector techniques in the production of computer graphics.
3. Gain familiarity of line drawing, clipping algorithms and rasterization techniques and interaction with input devices.
4. Understand viewing, lighting and shading techniques.
5. Design and create graphics applications using OpenGL.

Course Content

Unit – 1

Introduction : Applications of computer graphics, A graphics system, Images: Physical and synthetic, Imaging Systems, The programmer's interface, Graphics architectures, Programmable Pipelines, Performance Characteristics, Graphics Programming: The OpenGL: The OpenGL API, Primitives and attributes, Color, Viewing, Control functions, The Gasket program, Polygons and recursion, The three-dimensional gasket.

Self-Study Component: The synthetic camera model

10 Hours

Unit – 2

Geometric Transformations : Basic Two-Dimensional Geometric Transformations, Matrix Representations and Homogeneous Coordinates, Inverse Transformations, Two-Dimensional Composite Transformations, Other Two-dimensional Transformations, Raster Methods for Geometric Transformations, OpenGL Raster Transformations, Transformations Between Two Dimensional Coordinate Systems, Geometric transformations in Three Dimensional Space, Three Dimensional Translation, Three Dimensional Rotation, Three Dimensional Scaling, Composite Three Dimensional Transformations, Other Three Dimensional Transformations, Transformations Between Three Dimensional Coordinate Systems, Affine Transformations, OpenGL Geometric Transformation Functions

Self-Study Component: Scalars, vectors and points and Frames in OpenGL

11 Hours

Unit – 3

Implementation: Coordinate Reference Frames, Line Drawing Algorithms, Circle Generating Algorithms, Fill-Area Primitives, Polygon Fill Areas, Clipping Algorithms, Two-Dimensional Point Clipping, Two Dimensional Line Clipping: Cohen Sutherland Line Clipping, Liang Barsky Line Clipping, Polygon Fill Area Clipping: Sutherland –Hodgeman Polygon Clipping.

Input and Interaction: Interaction, Input devices, Clients and Servers, Display Lists, Display Lists and Modeling, Programming Event Driven Input, Menus, Picking, , Building Interactive Models, Animating Interactive Programs, Design of Interactive Programs, Logic Operations.

Self-Study Component: OpenGL Polygon Fill Area Functions

11 Hours

Unit – 4

Viewing: Classical and computer viewing, Positioning of the camera, Simple projections, Projections in OpenGL, Hidden-surface removal, Interactive Mesh Displays, Parallel-projection matrices, Perspective-projection matrices, Projections and Shadows.

Self-Study Component: Viewing with a Computer

10 Hours

Unit – 5

Lighting and Shading: Light and matter, Light sources, The Phong lighting model, Computation of vectors, Polygonal shading, Approximation of a sphere by recursive subdivisions, Light sources in OpenGL, Specification of materials in OpenGL. Shading of the sphere model, Global illumination.

Curves and Surfaces: Representation of Curves and surfaces, Hermite Curves and Surfaces, Bezier curves and Surfaces, The Utah Teapot.

Self-Study Component: Cubic B-Splines

10 Hours

Text Books:

1. Interactive Computer Graphics A Top-Down Approach with OpenGL, Edward Angel 6th Edition, Addison Wesley.
2. Computer Graphics, OpenGL Version – Donald Hearn and Pauline Baker, 4th Edition, Pearson publications

Reference Books:

1. F.S. Hill,Jr, and M. Kelley, Jr. "Computer Graphics Using OpenGL", Pearson/PHI, 3rd Edition, 2009.
2. James D Foley, Andries Van Dam, Steven K Feiner, John F Hughes, "Computer Graphics", Addison-Wesley.

Course Outcomes:

1. **Apply** the concepts of Application Programming Interface (API) based on graphics pipeline approach.
2. **Develop** mathematical transformation for generating graphics images.
3. **Develop** rasterization and input interaction techniques
4. **Apply** different types of projection methods.
5. **Determine** different rendering techniques and generation of curves in OpenGL.

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 505.1	**Apply** the concepts of Application Programming Interface (API) based on graphics pipeline approach	3	1	1		3						2			2
CO 505.2	**Develop** mathematical transformations for generating graphics images.	2	2	3		3						2			3
CO 505.3	**Develop** rasterization and input interaction techniques	2	2	3		3						2			3
CO 505.4	**Apply** different types of projection methods	3	2	2		3						2			2
CO 505.5	**Determine** different rendering techniques and generation of curves in OpenGL	2	2	3		3						2			3
C505		**2.4**	**1.8**	**2.4**		**3**						**2**			**2.6**

ELECTIVE-I

Course Title : Digital Image Processing			
Course Code: P17CS561	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. To understand the image fundamentals.
2. To understand the mathematical transforms necessary for image processing and to study the image enhancement techniques.
3. To understand the image degradation/restoration model and different noise models.
4. To understand the uses of pseudo colors and to study the image compression models.
5. To understand Morphological Image Processing and the image segmentation.

Course Content

Unit – 1

Digital Image Fundamentals: What is Digital Image Processing, fundamental Steps in Digital Image Processing, Components of an Image processing system, Elements of Visual Perception, Image Sensing and Acquisition, Image Sampling and Quantization, Some Basic Relationships between Pixels?

Self-study component: Linear and Nonlinear Operations

10 Hours

Unit – 2

Image Enhancement in Spatial domain: Some Basic Gray Level Trans– formations, Histogram Processing.

Image Enhancement In Frequency Domain: Introduction to the Fourier transform, smoothing frequency domain filters, sharpening frequency domain filters.

Self-study component: Enhancement Using Arithmetic/Logic Operations

11 Hours

Unit – 3

Image Restoration: Noise models, Restoration in the Presence of Noise, Only– Spatial Filtering, Periodic Noise Reduction by Frequency Domain Filtering, Linear Position– Invariant Degradations, inverse filtering, minimum mean square error (Weiner) Filtering

Self-study component: Model of image degradation/restoration process

11 Hours

Unit – 4

Color Image Processing: Color fundamentals, color models, pseudo color Image processing, basics of full color image processing.

Image Compression: Fundamentals, Image Compression Models, Elements of Information Theory

Self-study component: Color transformations

10 Hours

Unit – 5

Morphological Image Processing: Dilation and Erosion, opening and closing, **Image Segmentation**

Detection of discontinuities, Edge Linking and Boundary Detection, Thresholding, Region– Based Segmentation.

Self-study component: Morphological algorithms.

10 Hours

Text Book:

1. "Digital Image Processing", Rafael C. Gonzalez and Richard E. Woods Pearson Education, 2009, 3rd edition.

Reference Books:

1. "Fundamentals of Digital Image Processing", Anil K. Jain, Pearson Edition, 2001.
2. "Digital Image Processing", S. Jayaraman and others.

Course Outcomes

After learning all the units of the course, the student is able to

1. Describe the various steps in image processing.
2. Develop the suitable filters for image enhancement.
3. Analyze the image degradation restoration model and noise models.
4. Apply the color image processing techniques.
5. Develop the algorithms for image segmentation and Morphological image processing.

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02
C101.1	Describe the various steps in image processing.	2	2			2				1			1	2	1
C101.2	Develop the suitable filters for image enhancement.	2	2	2	2	2				1			1	2	1
C101.3	Analyze the image degradation restorationn model and noise models.	2	2	2	2	2				1			1	2	1
C101.4	Apply the colour image processing techniques	2	2	2	2	2				1			1	2	1
C101.5	Develop the algorithms for image segmentation and Morphological image processing.	2	2	2	2	2				1			1	2	1

Course Title : JAVA & J2EE			
Course Code: P17CS562	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives:

1. **Adopt** object oriented features to develop java applications, **Handle** the exceptions And **describe** key issues of modern animations.
2. **Apply** the multithreading programming to solve synchronization problems and **Develop** generic methods and classes..
3. **Write** the java applications to deal with events using delegation event model, develop the applets and **describe** the use of collection framework.
4. **Describe JDBC process , Use** statement object to manipulate database and **Create** a J2ee component using java servlet technology.
5. **Create** a JSP that can be used as a middle level program between clients and web Services, **Use** Java Remote Method Invocation to invoke Server side objects that are Written in Java, **Create** and use JavaBeans.

Course Content

Unit –1

I**ntroduction**, History of Java, Java Buzzwords, Java's Bytecode, Java Development Kit (JDK), Object oriented programming, Simple Java programs.

Introducing classes: Class Fundamentals, Declaring Object, Constructors, This key word, Garbage collection, overloading methods, Acess control, final key word, nested and inner classes.

Inheritance: Simple, multiple, and multilevel inheritance, Super classes, Order of calling constructors, Overriding, Using final with inheritance.

Interfaces and packages, Exception handling in Java.

Enumerations, Autoboxing: Enumerations, Type Wrappers, Autoboxing, Annotations (Metadata).

Self-study component: Assigning object reference variables, Abstract classes

10 Hours

Unit – 2

Input/Output: The java I/O Classes and Interfaces, File, The closable ad Flushable Interfaces, The Stream classes, The Byte Stream, InputStream, OutputStream, FileInput Stream, FileOutputStream, PrintStream, The Character Stream, Reader, Writer, FileReader, FileWriter, CharacterArrayReader, CharacterArrayWriter, **Generics :** Introduction, A Simple Generics Example, A Generic Class with Two Type Parameters, The Generic Form of a Generic Class, Bounded Types, Using Wildcard Arguments, Creating a Generic Method, Generic Interfaces, Generic Class Hierarchies, Ambiguity Errors, Some generic Restrictions.

Multi-threaded programming: Java's thread model, the main thread, creation of threads, Multiple threads, isAlive() and join(), thread priorities, Synchronization, Interthread communication, suspending, reassuming, and stopping threads.

Self-study component: The Console Class.

11 Hours

Unit – 3

The Collections Framework : Collections Overview, Recent Changes to Collections, The Collections Interfaces, The Collection Classes, Accessing a Collection via an Iterators, storing user defined classes in collections, The Random Access Interface, Comparators, The

Collection Algorithms, arrays, The Legacy Classes and Interfaces: enumeration, interface, vector, stack.

Applets: Two types of Applets, Applet basics, Applet Architecture, An Applet skeleton, Simple Applet display methods, Requesting repainting, using the Status Window, The HTML APPLET tag, passing parameters to Applets.

Event Handling: Event handling mechanisms, the delegation event model, Event classes, Sources of events, Event listener interfaces, using the delegation event model, Adapter Classes, Inner classes.

Self-study component: get Document base () and get Codebase ().

10 Hours

Unit –4

Java 2 enterprise edition overview, database access: Overview of J2EE and J2SE. The Concept of JDBC, JDBC Driver Types, JDBC Packages, A Brief Overview of the JDBC process, Database Connection, Associa the Database, Statement Objects, ResultSet, Transaction Processing.

Servlets : Background, The Life Cycle of a Servlet, Using Tomcat for Servlet Development, A simple Servlet, The Servlet API, The Javax.servlet Package, Reading Servlet Parameter, The Javax.servlet.http package, Handling HTTP Requests and Responses, Using Cookies, Session Tracking

Self-study component: Metadata, Data types, Exceptions.

11 Hours

Unit – 5

JSP: Java Server Pages (JSP): JSP, JSP Tags. Tomcat, Request String, User Sessions, Cookies, Session Objects.

Java Remote Method Invocation: Remote Method Invocation concept, Server side, Client side.

Enterprise java beans: Enterprise Java Beans, Deployment Descriptors, Session Java Bean, Entity Java Bean, Message-Driven Bean.

Self-study component: The JAR File.

10 Hours

Text Books:

1. **Java the Complete Reference**-Herbert Schildt, 9th Edition, Tata McGraw Hill, 2014.
2. **J2EE The Complete Reference** - Jim Keogh, McGraw Hill. 2015.

Reference Books:

1. **Introduction to JAVA Programming** - Y. Daniel Liang, 10th Ed., Pearson Ed, 2015.
2. **The J2EE Tutorial**, Stephanie Bodoff et ak, 2nd Edition Pearson Education, 2012.

Course outcomes

1. **Distinguish** between various object-oriented concepts.
2. **Design** the solution using multithreading and generic classes.
3. **Develop** applications using frameworks and applets with events handling.
4. **Develop** programs using JDBC and Servlets.
5. **Create**J2ee component using JSP and EJB technology.

CO-PO Mapping

Course code : P17CS562							Title : JAVA & J2EE								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO 5062.1	**Distinguish** between various object-oriented concepts.	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO 5062.2	**Design** the solution using multithreading and generic classes.	2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO 5062.3	**Develop** applications using frameworks and applets with events handling.	2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO 5062.4	**Develop** programs using JDBC and Servlets.	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO 5062.5	**Create**J2ee component using JSP and EJB technology.	2	1	1	-	-	-	-	-	-	-	-	-	2	-
		2	**1.8**	**2**										**3.2**	

Course Title : Storage Area Networks			
Course Code: P17CS563	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

The course aims to:

1. Discuss the fundamentals of storage centric and server centric systems
2. Analyze the metrics used for Designing storage area networks
3. Explain the RAID concepts
4. Explain strong virtualization concepts.
5. Apply the techniques used for data maintenance.

Course Content

Unit -1

Introduction: Server Centric IT Architecture and its Limitations; Storage – Centric IT Architecture and its advantages. Case study: Replacing a server with Storage Networks the Data Storage and Data Intelligent Disk Subsystems: Architecture of Intelligent Disk Subsystems; Hard disks and Internal I/O Channels; JBOD, Storage virtualization using RAID and different RAID levels; Caching: Acceleration of Hard Disk Access; Intelligent disk subsystems, Availability of disk subsystems.

Self-study component: Intelligent disk subsystems, Availability of disk subsystems.

10 Hours

Unit -2

I/O Techniques: The Physical I/O path from the CPU to the Storage System; SCSI; Fibre Channel Protocol Stack; Fibre Channel SAN; IP Storage. Network Attached Storage: The NAS Architecture, The NAS hardware Architecture, The NAS Software Architecture, Network connectivity, NAS as a storage system. File System and NAS: Local File Systems; Network file Systems and file servers; Shared Disk file systems; Comparison of fibre Channel and NAS.

Self-study component: Local File Systems; Network file Systems and file servers

10 Hours

Unit -3

Storage Virtualization: Definition of Storage virtualization; Implementation Considerations; Storage virtualization on Block or file level; Storage virtualization on various levels of the storage Network Symmetric and Asymmetric storage virtualization in the Network.

Self-study component: Local File Systems; Network file Systems and file servers.

10 Hours

Unit -4

SAN Architecture and Hardware devices: Overview, Creating a Network for storage; SAN Hardware devices The fibre channel switch; Host Bus Adaptors; Putting the storage in SAN; Fabric operation from a Hardware perspective. Software Components of SAN: The switch's Operating system; Device Drivers; Supporting the switch's components; Configuration options for SANs.

Self-study component: Putting the storage in SAN

10 Hours

Unit -5

Management of Storage Network: System Management, Requirement of management System, Support by Management System, Management Interface, Standardized Mechanisms, Property Mechanisms, In-band Management, Use of SNMP, CIM and WBEM, Storage

Management Initiative Specification (SMI-S), CMIP and DMI, Optional Aspects of the Management of Storage Networks, Summary.

Self-study component: Management Interface

10 Hours

Text Books:

1. Ulf Troppens, Rainer Erkens and Wolfgang Muller: Storage Networks Explained, Wiley India, 2015.
2. Robert Spalding: "Storage Networks The Complete Reference",Tata McGraw-Hill,2011

Reference Books:

1. Marc Farley: Storage Networking Fundamentals – An Introduction to Storage Devices, Subsystems, Applications, Management, and File Systems, Cisco Press, 2005.
2. Richard Barker and Paul Massiglia: "Storage Area Network Essentials a Complete Guide to understanding and Implementing SANs", Wiley India, 2006.

Course Outcomes:

1. The students shall able to:
2. Discuss the fundamentals of storage centric and server centric systems
3. Analyze the metrics used for Designing storage area networks
4. Explain the RAID concepts
5. Explain strong virtualization concepts.
6. Apply the techniques used for data maintenance.

CO-PO Mapping

Semester : 5th	**Course code :P17CS563**					**Title : Storage Area Networks**								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
C101.1	Discuss the fundamentals of storage centric and server centric systems	2												2	2
C101.2	Analyze the metrics used for Designing storage area networks techniques.	2												2	3
C101.3	Explain the RAID concepts.	2	3											3	2
C101.4	Explain strong virtualization concepts, composition, orchestration and Choreography.	2	2	2										3	2
C101.5	Apply the techniques used for data maintenance.	2	2	2										3	3
C101		**2**	**2.2**	**2**										**2.6**	**2.4**

Course Title : Artificial Intelligence			
Course Code: P17CS564	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Outcomes:

After successful completion of the course, students will be able to,

1. Explain how Artificial Intelligence& Intelligence Systems enables capabilities that are beyond conventional technology.
2. Discusses how a heuristic state – space search algorithms are used to solve complex problem.
3. Analyze and design a rule-based expert system with tools.
4. Design *fuzzy-logic* based controllers and explore their unique characteristics.
5. Understanding of genetic algorithm and an outlook on the applications of genetic algorithm

Course Content

Unit -1

Introduction to artificial intelligence : Artificial Intelligence: Importance, Definitions, Programming Methods, Techniques; Intelligent Systems; Predicate Calculus; Rule-Based Knowledge Representation; Symbolic Reasoning Under Uncertainty; Basic Knowledge Representation Issues.

Self-study component: AI Problem Solving Languages – PROLOG, Control Structures used in Rule – Based System **11 Hours**

Unit -2

Heuristic search and state space search: Heuristic Search; Techniques for Heuristic Search; Heuristic Classification; Intelligent Agents State Space Search; Strategies for State Space Search; Learning; Applications of Search Techniques in Game Playing and Planning.

Self-study component: AI Problem Solving Languages – Search, LISP **10 Hours**

Unit -3

Expert Systems : Expert Systems; Stages in the development of an Expert Systems; Probability based Expert Systems; Expert System Tools; Applications of Expert Systems.

Self-study component: Expert System – Applications of Expert System **10 Hours**

Unit -4

Fuzzy Systems: Introduction to fuzzy systems; Foundation of fuzzy Systems; Linguistic Description and their Analytical Forms; Defuzzification Methods; Fuzzy logic in Control and Decision-making Applications.

Self-study component: Fuzzy Systems-Fuzzy Relations, arithmetic operation of Fuzzy number **10 Hours**

Unit -5

Advanced Intelligent System Concepts: Introduction to Genetic Algorithms; Genetic Algorithms; Procedures of Genetic Algorithms; The working of Genetic Algorithms; Logic behind Genetic Algorithms. Swarm Intelligent Systems Ant Colony Systems; Development of Ant Colony Systems; Applications of Ant Colony Intelligence

Self-study component: Swarm Intelligent System – Background of Ant Intelligent Systems, Importance of the Ant Colony Paradigm **11 Hours**

Text Book:

1. N.P.Padhy: Artificial Intelligence and Intelligent Systems, Oxford University Press, 2017.

Reference Book:

1. Efraim Turban, Jay E. Aronson, Ting-Peng Liang**:** Decision Support Systems and Intelligent Systems, VII Edition, Prentice-Hall of India.

Course Title : Aptitude and Reasoning Development - Advanced (ARDA)			
Course Code : P17HU510	Semester : 5	L:T:P:H :0:0:2:2	Credits: 1
Contact Period: Lecture: 32 Hr, Exam: 3 Hr		Weightage: CIE:50;% SEE:50%	
Prerequisites: Vocabulary builder, Concept of Percentage.			

Course Learning Objectives (CLOS)

This course aims to,

1. Describe the importance of reading with comprehension.
2. Explain seven dimensions approach to better reading skills.
3. Explain the purpose, plan and the ways to identify specific details in a paragraph for better comprehension.
4. Formulate easier ways to solve problems of averages.
5. Explain the Application of the technique of alligation while solving weighted average and mixture problems.
6. Describe the concepts of profit, loss, discount, marked price.
7. Explain the application of percentage in our daily life.
8. Discover different ways to identify the progressions and to compare between AP< GP and HP.
9. Explain the basic concepts in calculating simple interest and compound interest.
10. Differentiate between simple interest and compound interest and describes the importance of compound interest and its behavior.

Course Content

UNIT – I

Reading Comprehension:

Introduction: Read more and more, the process of writing and its relevance to the process of writing, how reading skills are important for aspects other than the reading comprehension questions, the daily reading scheme.

Seven dimension approach to better reading skills:

Developing the ability of understanding vocabulary in context, Ability to identify and understand main ideas, Ability to predict and identify supporting details, Understanding the use of transition and idea organization patterns, Inferences, Identifying purpose and tone, Recognizing and evaluating arguments and their common structures.

Theory of reading comprehension:

Solving RC passages is an exact science, tackling RC on the basis of evaluation of support, All passages have a topic, purpose and a plan, Other things to pick up while reading the passage– The tonality and other software related the author's viewpoint in the passage, specific details and their use in the passage, Types of questions asked in reading comprehension passage.

10 Hours

UNIT – II

Averages and Alligations mixtures:

Average: relevance of average, meaning of average, properties of average, deviation method, concept of weighted average. **Alligation method:** situation where allegation technique, general representation of alligations, the straight line approach, application of weighted average and alligation method in problems involving mixtures. Application of alligation on situation other than mixtures problems.

6 Hours

UNIT – III

Profit and Loss: percentage change, original 100 concept effect of percentage increase or decrease in number, effect of successive percentage change, amount of change, comparison of two numbers through percentage and ratio, return to original concept, net percentage change to keep product fixed. Definition of basic terms— cost price, selling price, profit percentage, discount and marked price, solving problems using n/d method, techniques to tackle from standard set of problems, the concept of mark up. Concept of partnership and problems involving partnership

6 Hours

UNIT IV

Progression:

Arithmetic Progression: sum of given number of terms in an A.P., arithmetic mean, to insert a given number of arithmetic means between two given quantities, nth term of an A.P., finding common difference of an A.P. given 2 terms of an A.P., types of A.P.s– increasing A.P.s and decreasing A.P. s

Geometric: to find, the geometric mean between two given quantities, to insert a given number of geometric means between two given quantities, sum of a number of terms in a G.P. Types of G.P.s— increasing G. P. s type one and two , decreasing G. P. s type one and two.

Harmonic Progression: to find the harmonic mean between two given quantities, theorems related with progressions, solved examples sample company questions

6 Hours

UNIT- V

Simple Interest and Compound Interest

Concept of time value of money, Terminology pertaining to interest, Relation among Principal, Time, Rate percent per annum and total interest. Compound interest, Depreciation of value, Population, Application of interest in D.I.– The difference between simple annual growth rate and compound annual growth rate.

4 Hours

Reference books:

1. **Trachtenberg speed system of basic mathematics**, published by Rupa publications.
2. AbhijithGuha **"CAT Mathematics"** published by PHI learning private limited.
3. Dr. R. S Agarwal "**Quantitative aptitude**" published by S.Chand private limited.
4. Dr. R. S Agarwal , " **Verbal reasoning**" published by S. Chand private limited.
5. Arun Sharma "**Quantitative aptitude**" for CAT by, published by McGraw Hill publication.

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Apply the approach of seven dimensions to better reading skills. L2
2. Solve the questions under reading comprehension confidently with higher accuracy than random reading. L4
3. Apply the technique of alligation for effective problem solving. L2
4. Interpret the requirement of different methods of calculating average and apply the right method at right scenario. L4
5. Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest. L5
6. Formulate the equations for summation and other functions for all the kinds of progressions– AP, GP and HP. L1

Course Articulation Matrix (CAM)															
Course Outcome (CO)	Program Outcome (ABET/NBA-(3a-k))														
		PO 1	PO 2	PO3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2
Apply the approach of seven dimensions to better reading skills.	L2	-	-	-	-	-	-	-	-	2	-	-	-	-	-
Solve the questions under reading comprehension confidently with higher accuracy than random reading.	L4	-	-	-	-	-	-	2	-	2	-	-	-	-	-
Apply the technique of alligation for effective problem solving.	L2	3	-	-	-	-	-	-	-	-	-	-	-	-	-
Interpret the requirement of different methods of calculating average and apply the right method at right scenario.	L4	2	-	-	-	-	-	-	-	2	-	-	-	-	-
Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.	L5	3	-	-	-	-	-	-	-	2	-	-	-	-	-
1 – Low, 2 – Moderate and 3 – High															

VI Semester

Course Title : Entrepreneurship Management & IPR			
Course Code: P17CS61	**Semester : 6**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives:

The students should be able to

1. **Describe** the importance of management and functions of a manager
2. **Explain** the process of planning and organizing.
3. **Explain** the requirements of direction and supervision and **explain** the methods of establishing control.
4. **Identify** the role of entrepreneurs in the economic development of the nation and recognize the barriers of entrepreneurship.
5. **Explain** the importance of Intellectual property protection.

Course Content

Unit–1

Management : importance of management, definition, management functions, roles of a manager, levels of management ,managerial skills, management and administration, management –a science or art, management – a profession , professional management v/s family management. Development of management thought; early classical approaches, Neo classical approaches, modern approaches.

Self-study component: Case studies on management and administration.

10 Hours

Unit–2

Planning: Nature, Importance of planning, forms, types of plans, steps in planning, limitations of planning, making planning effective, planning skills, strategic planning in Indian industry.

Organization: Meaning, process of organizing, span of management principles of organizing, Depart mentation, organization structure, committees, teams.

Self-study component: Staffing: Selection, requirement and training.

10 Hours

Unit–3

Direction and supervision: Requirements of effective direction, giving orders, motivation, job satisfaction, morale, organizational commitment, first level supervision or front line supervision.

Controlling: Meaning and steps in controlling, Essential of a sound control system, Methods of establishing control.

Self-study component: Leadership: Leadership styles, effective leadership.

10 Hours

Unit–4

Entrepreneurship: Meaning of Entrepreneur; Evolution of the Concept, Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur – an emerging Class. Concept of Entrepreneurship – Evolution of Entrepreneurship, Development of Entrepreneurship, Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship – its Barriers.

Self-study component: Case studies of successful entrepreneurship.

11 Hours

Unit–5

Intellectual Property Rights: Introduction to IPR, origin and concepts of IPR, Concept of property, Forms of IP protection: Patents, copyrights, trademarks, designs, Trade secrets, Traditional knowledge, Geographical indications. Basic concepts and historical background of patent system and law- National and international scenario (American & European Patent Regimes). International Treaties/Conventions on IPR: Paris Convention, Berne convention, Madrid agreement, Rome convention, World Intellectual Property Organization (WIPO), World Trade Organization, TRIPS Agreement, Patent Co-operation Treaty

Self-study component: Ethical issues related to intellectual property rights.

11 Hours

Text Books:

1. Management and Entrepreneurship**,** N V R Naidu, T Krishna Rao 4th reprint 2010.
2. Law relating to Intellectual Property rights, B.L.Wadhera, 5th ed. Universal law Publishing, 2011

Reference Books:

1. **Principles of Management**, P C Tripathi, P N Reddy, 5th edition, TataMcGraw Hill, 2012
2. **Dynamics of Entrepreneurial Development & Management**, Vasant Desai, Himalaya publishing house, 2009

Course Outcomes

Upon completion of this course, students will be able to

1. **Describe** the importance of management and functions of a manager.
2. **Explain** the process of planning and principles of organizing.
3. **Identify** the role of entrepreneurs in the economic development of the nation.
4. **Compare** the different leadership styles.
5. **Apply** the ethical principles related to the intellectual property protection

CO-PO Mapping

CO	Statement	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS 01	PS 02
C101.1	**Describe** the importance of management and functions of a manager	2					2	2				2		2	1
C101.2	**Explain** the process of planning and principles of organizing.	2					2	2				2		2	1
C101.3	**Identify** the role of entrepreneurs in the economic development of the nation	2					2	2				2		2	1
C101.4	**Compare** the different leadership styles	2					2			2		2		2	1
C101.5	**Apply** the ethical principles related to the intellectual property protection	2					2		2			2		2	1

Course Title : Computer Architecture			
Course Code: P17CS62	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course learning objectives

In this course students should be able to,

1. Understand the evolution of computers, choosing the parameters needed to evaluate the performance of architectures, classification of computers to perform multiprocessing, fundamental properties of how parallelism can be introduced in program.
2. Discuss the present modern processor technology and the supporting memory hierarchy, Bus for interconnection between different processor, how shared memory concept is used in multiprocessor.
3. Examine the basic properties of pipelining, classification of pipeline processors, plan solutions for the pipeline processors.
4. Understand System architectures of multiprocessor and multicomputer, various cache coherence protocols, synchronization methods, other important concepts involved in building a multicomputer and message passing mechanisms.
5. Understand how to perform parallelization of computations of data and acquiring knowledge about scalable multiprocessor systems and different scaling methods.

Course Content

Unit–1

Parallel Computer Models: The State of Computing, Multiprocessor and Multicomputer, Multivector and SIMD Computers, Conditions of Parallelism, Partitioning and Scheduling, Program flow Mechanisms, System Interconnect Architecture.

Self-study component: Program and Network Properties

10 Hours

Unit–2

Processor and Memory Hierarchy: Advanced Processor Technology, Design space of processors, Instruction Set Architectures, CISC Scalar Processor (exclude CISC Microprocessor Families), Superscalar and Vector Processor, Superscalar Processor (exclude IBM Rs/6000 Architecture), VLIW Architecture.

Bus and Shared Memory: Bus Systems, Shared– Memory Organization, Interleaved Memory Organization, Bandwidth and fault Tolerance, Memory Allocation Schemes(exclude swapping in Unix, Demand Paging system and Hybrid Paging system).

Self-study component: RISC Scalar Processor (exclude Sun Microsystems SPARC architectures)

10 Hours

Unit–3

Pipelining and Superscalar Techniques: Linear Pipeline Processors: Asynchronous and Synchronous Models, Clocking and Timing Control, Speed up, Efficiency and Throughput, Non-linear Pipeline Processors: Reservation and Latency Analysis, Collision free scheduling, Pipeline schedule optimizations, Instruction pipeline design: Instruction Execution Phases, Mechanism for Instruction Pipelining, Dynamic Instruction Scheduling.

Self-study component: Branch handling Techniques, Arithmetic Pipeline Design: Computer Arithmetic Principles, Static Arithmetic Pipeline, Multifunctional Arithmetic Pipelines (exclude IMB360 Floating Point unit).

11 Hours

Unit–4

Multiprocessor and Multi-computers: Multiprocessor system Interconnects, Hierarchical Bus Systems, Cache Coherence and Synchronization Mechanisms, The Cache Coherence Problem, Snoopy Bus Protocol, Directory based Protocols, Hardware Synchronization Mechanisms, Message Passing mechanisms: Message Routing Schemes, Deadlock and Virtual Channels, Flow Control Strategies.

Self-study component: Crossbar Switch and Multiport Memory, Multistage & Combing N/W

10 Hours

Unit–5

Parallel Programs: Parallel Application Case Studies: Simulating ocean Currents, Simulating the Evolution of Galaxies, Visualization Complex Scenes using Ray Tracing, Mining Data for Associations, The Parallelization Process: Steps in The Process, Parallelization Computation Versus Data, Parallelization of an Example Program: The Equation Solver Kernel, Decomposition, Assignment, Orchestration under the Shared address Space Model, Orchestration under the Message –Passing Model.

Scalable Multiprocessors: Scalability, Bandwidth scaling, Latency scaling, Cost Scaling, Physical Scaling, Realizing Programming Model: Primitive Network Transaction, Shared address Space, Message Passing.

Self-study component: Goals of the Parallelization Process.

11 Hours

Text Books:

1. Kai Hwang & Naresh Jotwani, ”Advanced Computer Architecture”, Parallelism, Scalability, Programmability 2 nd edition McGraw Hill 2012.
2. David E Culler Jaswinder Pal Singh with Anoop Gupta, “Parallel Computer Architecture” A Hardware/Software Approach, Morgan Kaufmann Publications Elsevier 2012.

Reference Books:

1. John P Hayes, Computer Architecture & Organization 3rd Edition McGraw Hill 1998.
2. V.Rajaraman, C.Siva Ram Murthy, Parallel Computers-Architecture and Programming PHI, 2000.

Course Outcomes

1. **Describe** the evolution of computers
2. **Characterize** the present modern technology and supporting memory hierarchy
3. **Analyze** the basic properties of pipelining
4. **Discuss** system architecture of multiprocessor and multicomputer
5. **Analyze** the steps to perform parallelization of computation

CO-PO Mapping

Semester: 6th	Course code : P17CS62						Title : Computer Architecture								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**
CO 604.1	**Describe** the evolution of computers	3	1	1										3	
CO 604.2	**Characterize** the present modern technology & supporting memory hierarchy	2	2	1										2	
CO 604.3	**Analyze** the basic properties of pipelining	2	3	2	1									2	
CO 604.4	**Discuss** system architecture of multiprocessor and multicomputer	3	2	2										3	
CO 604.5	**Analyze** the steps to perform parallelization of computation	2	3	2	1									2	
C604		**2.4**	**2.2**	**1.6**	**1**									**2.4**	

Course Title : Compiler Design			
Course Code: P17CS63	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

The main objective of this course is to gain in-depth knowledge in **understanding the** compilation process

1. **Understand** the phases of the compilation process and **Know** about the compiler generation tools, role of lexical analyzer for designing a compiler.
2. **Learn top down** parsing techniques.
3. **Learn Bottom up** parsing techniques and **analysis** of ambiguous grammar in the specification and implementation of languages.
4. **Know** how dependency graph is used in evaluation of SDD's, **Learn** role of a semantic analyzer and type checking, how allocation and deallocation can be done during run time.
5. **Learn** intermediate machine representations and understand the concept of code generation.

Course Content

Unit–1

Introduction, Lexical analysis, Syntax analysis: Various phases of a compiler, Grouping of phases; Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.
Self-study component: Compiler-Construction tools

10 Hours

Unit–2

Syntax Analysis–: Role of parser; Top-down Parsing.
Self-study component: Context-free grammars

11 Hours

Unit–3

Syntax Analysis: Bottom-up Parsing, LR parsers, using ambiguous grammars.
Self-study component: LALR parsers

10 Hours

Unit–4

Syntax-Directed Translation: Syntax-directed definitions; Construction of syntax tree; Evaluation orders for SDDs; Syntax-directed translation schemes. **Type checking**-Type Systems; Specification of a simple type checker; Equivalence of type expression; Type conversions.
Run-Time Environments: Source language issues; Storage Organization; Storage allocation strategies; parameter passing; dynamic storage allocation techniques.
Self-study component: Symbol tables

11 Hours

Unit–5

Intermediate Code Generation: Intermediate languages; declaration; Assignment statements; Boolean expressions; Case statements; Back patching ;Procedure calls.
Code Generation: Issues in the design of Code Generator; basic blocks and flow graphs; A simple code generation; Register allocation and assignment.
Self-study component: DAG representation of basic blocks.

10 Hours

Text Book:

1. Alfred V Aho, Monica S.Lam, Ravi Sethi, Jeffrey D Ullman: Compilers- Principles, Techniques and Tools, 2nd Edition, Pearson Education, 2007.

Reference Books:

1. Charles N. Fischer, Richard J. leBlanc, Jr.: Crafting a Compiler with C, Pearson Ed. 1991.
2. Andrew W Apple: Modern Compiler Implementation in C, Cambridge University Press, 1997.
3. Kenneth C Louden: Compiler Construction Principles & Practice, Cengage Learning 1997

Course Outcomes

1. **Design** simple lexical analyzer
2. **Construct** simple top down parser for a given context free grammar
3. **Construct** simple bottom up parser for a given context free grammar
4. **Apply** different syntax directed translation schemes
5. **Generate** intermediate and machine dependent code

CO-PO mapping

Semester: 6	Course code : P17CS63						Title : Compiler Design								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS O2**
CO 603.1	**Design** simple lexical analyzer	3	3	2	2	1								3	2
CO 603.2	**Construct** simple top down parser for a given context free grammar	3	3	3	3	1								3	3
CO 603.3	**Construct** simple bottom up parser for a given context free grammar	3	3	3	3	1								3	3
CO 603.4	**Apply** different syntax directed translation schemes	3	3	2	1									3	2
CO 603.5	**Generate** intermediate and machine dependent code	3	3	2	2									3	1
C603		3	3	2.4	2.2	1								3	2.2

Course Title : Data Mining &Warehousing(FC-II)			
Course Code: P17CS64	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 4**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course objectives:

This course will enable students to

1. Define Data warehousing Architecture and Implementation
2. Explain Data mining principles and techniques and Introduce DM as a cutting edge business intelligence
3. Interpret association rule mining for handling large data
4. Classification for the retrieval purposes
5. Explain clustering techniques in details for better organization and retrieval of data

Course Content

Unit - 1

Data warehousing and online analytical processing: Data warehousing: Basic concepts, Data warehouse modeling: Data cube and OLAP, Data warehouse design and usage, Data warehouse implementation, Data generalization by attribute-oriented induction.

Self-study component: Three Tier Data warehouse architecture

10 Hours

Unit – 2

Introduction and Data Preprocessing :Why data mining, What is data mining, What kinds of data can be mined, What kinds of patterns can be mined, Which Technologies Are used, Which kinds of Applications are targeted. Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.

Self-study component: Major issues in data mining

12 Hours

Unit – 3

Classification: Basic Concepts: Basic Concepts, Decision tree induction, Bays Classification Methods, Rule-Based classification, Model evaluation and selection.

Self-study component: Techniques to improve classification accuracy

10 Hours

Unit – 4

Mining Frequent Patterns, Associations, and Correlations: Basic Concepts and Methods: Basic Concepts, Frequent Itemset Mining Methods, Which Patterns Are Interesting?—Pattern Evaluation Methods, Pattern Mining in Multilevel, Multidimensional Space.

Self-study component: Constraint-Based Frequent Pattern Mining

10 Hours

Unit – 5

Cluster Analysis: Basic concepts and methods: Cluster Analysis, Partitioning methods, Hierarchical Methods, Density-based methods, Grid-Based Methods.

Self-study component: Evaluation of clustering.

10 Hours

Text Book:

1. Jiawei Han, MichelineKamber, Jian Pei: Data Mining Concepts and Techniques, ELSEVIER (MK) 3rd edition 2012.

Reference Books:

1. Arun K Pujari: Data Mining Techniques 2nd Edition, Universities Press, 2009.
2. Jiawei Han and MichelineKamber: Data Mining - Concepts and Techniques, 2nd

Edition, Morgan Kaufmann Publisher, 2006.
3. Alex Berson and Stephen J. Smith: Data Warehousing, Data Mining, and OLAP Computing, McGrawHill Publisher, 1997.
4. Insight into Data Mining-Theory and Practice-K.P.Soman, ShyamDiwakar, V.Ajay, PHI, 2006.

Course Outcomes

The students shall able to:

1. **Analyze** different data models used in data warehouse.
2. **Apply** different preprocessing techniques for different attributes.
3. **Determine** frequent item set using association rules.
4. **Apply** different classification techniques to classify the given data set.
5. **Analyze** different clustering techniques.

CO-PO mapping

Semester: 6th		Course code : P17CS64					Title :Data Mining &Warehousing(FC-II)								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS01**	**PS02**
CO 661.1	**Analyze** different data models used in data warehouse.	3	2			1									2
CO 661.2	**Apply** different pre-processing techniques for different attributes.	3	2	2		1									2
CO 661.3	**Determine** frequent item set using association rules.	3	2	2		1									2
CO 661.4	**Apply** different classification techniques to classify the given data set.	3	2	2		1									2
CO 661.5	**Analyze** different clustering techniques.	3	2	2		1									2
C661		**3**	**2**	**2**		**1**									**2**

ELECTIVE-II

Course Title : Client Server Programming			
Course Code: P17CS651	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. Understand the client-server software, context switching software and protocol software
2. Understand system calls , basic I/O functions in UNIX operating System
3. Understand the socket interface, TCP and UDP
4. Analyze various client software applications and there issues.
5. Understand the necessity of socket interface in client server programming

Course Content

Unit-1

The Client Server Model and Software Design: Introduction, Motivation, Terminology and Concepts

Concurrent Processing in Client-Server software: Introduction, Concurrency in Networks, Concurrency in Servers, Terminology and Concepts, An example of Concurrent Process Creation, Executing New Code, Context Switching and Protocol Software Design, Concurrency and Asynchronous I/O.

Program Interface to Protocols: Introduction, Loosely Specified Protocol Software Interface, Interface Functionality, Conceptual Interface Specification, System Calls, Two Basic Approaches to Network Communication, The Basic I/O Functions available in UNIX, Using UNIX I/O with TCP/IP.

12 Hours

Unit-2

The Socket Interface: Introduction, Berkley Sockets, Specifying a Protocol Interface, The Socket Abstraction, Specifying an End Point Address, A Generic Address Structure, Major System Calls used with Sockets, Utility Routines for Integer Conversion, Using Socket Calls in a Program, Symbolic Constants for Socket Call
Parameters.

Algorithms and Issues in Client Software Design: Introduction, Learning Algorithms instead of Details, Client Architecture, Identifying the Location of a Server, Parsing an Address Argument, Looking up a Domain Name, Looking up a well-known Port by Name, Port Numbers and Network Byte Order, Looking up a Protocol by Name, The TCP Client Algorithm, Allocating a Socket, Choosing a Local Protocol Port Number, A fundamental Problem in choosing a Local IP Address, Connecting a TCP Socket to a Server, Communicating with the Server using TCP, Reading a response from a TCP Connection, Closing a TCP Connection, Programming a UDP Client, Connected and Unconnected UDP Socket, Using Connect with UDP, Communicating with a Server using UDP, Closing a Socket that uses UDP, Partial Close for UDP, A Warning about UDP Unreliability

10 Hours

Unit-3

Example Client Software: Introduction, the Importance of Small Examples, Hiding Details, an Example Procedure Library for Client Programs, Implementation of Connect TCP,

Implementation of Connect UDP, A Procedure that Forms Connections, Using the Example Library, The DAYTIME Service, Implementation of a TCP Client for DAYTIME,
Reading from a TCP Connection, the Time Service, Accessing the TIME Service, Accurate Times and Network Delays, A UDP Client for the TIME Service, The ECHO Service, A TCP Client for the ECHO Service, A UDP Client for the ECHO Service.

10 Hours

Unit-4

Algorithms and Issues in Server Software Design: Introduction, The Conceptual Server Algorithm, Concurrent Vs Iterative Servers, Connection-Oriented Vs Connectionless Access, Connection-Oriented Servers, Connectionless Servers, Failure, Reliability and Statelessness, Optimizing Stateless Servers, Four Basic Types of Servers, Request Processing Time, Iterative Server Algorithms, An Iterative Connection-Oriented Server
Algorithm, binding to a Well Known Address using INADDR_ANY, Placing the Socket in Passive Mode, Accepting Connections and using them. An Iterative Connectionless Server Algorithm, Forming a Reply Address in a Connectionless Server, Concurrent Server Algorithms, Master and Slave Processes, A Concurrent Connectionless Server Algorithm, A concurrent Connection-Oriented Server Algorithm, Using separate Programs as Slaves, Apparent Concurrency using a Single Process, When to use each Server Types, The Important Problem of Server Deadlock, Alternative Implementations.

10 Hours

Unit-5

Iterative, Connectionless Servers (UDP): Introduction, Creating a Passive Socket, Process Structure, An example TIME Server. **Iterative, Connection-Oriented Servers (TCP):** Introduction, Allocating a Passive TCP Socket, A Server for the DAYTIME Service, Process Structure, An Example DAYTIME Server, Closing Connections, Connection Termination and Server Vulnerability.
Concurrent, Connection-Oriented Servers (TCP): Introduction, Concurrent ECHO, Iterative Vs Concurrent Implementations, Process Structure, An example Concurrent ECHO Server, Cleaning up Errant Processes.

10 Hours

Text Book:

1. Douglas E.Comer, David L. Stevens: Internetworking with TCP/IP – Vol. 3, Client-Server Programming and Applications, BSD Socket Version with ANSI C, 2nd Edition, Pearson, 2001

Course Outcomes

After learning all the units of the course, the student is able to

1. **Understand and apply** client server software
2. **Identify** context switching software and protocol software
3. **Explore** system calls , basic I/O functions in UNIX operating System
4. **Develop** socket interface, TCP and UDP program
5. **Apply** socket interface in client server programming

CO-PO Mapping

Semester: 6th		Course code : P17CS651					Title : Client Server Programming								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**
CO1	**Understand and apply** client server software	2	2											3	3
CO2	**Identify** context switching software and protocol software	2	2											2	2
CO3	**Explore** system calls, basic I/O functions in UNIX operating System	2	2											2	3
CO4	**Develop** socket interface, TCP and UDP program	2	2											3	3
CO5	**Apply** socket interface in client server programming	2	2											3	3
CO		**2**	**2**											**2.6**	**2.8**

Course Title : Soft Computing Technique			
Course Code: P17CS652	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

This course aims to

1. Understand the concepts of feed forward neural networks
2. Understand the feedback neural networks
3. Understand the concept of fuzziness involved in various systems
4. Understand the ideas about genetic algorithm
5. Understand the FLC and NN toolbox

Course Content

Unit-1

Introduction of soft computing : Soft computing vs. hard computing various types of soft computing techniques- applications of soft computing-Neuron- Nerve structure and synapse-Artificial Neuron and its model- activation functions- Neural network architecture- singlelayer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model Adaline and Madaline-multilayer perception model back propogation learning back propogation learning methods- effect of learning rule coefficient.

Self-study component: Back propagation algorithm- factors affecting back propagation training- applications.

12 Hours

Unit-2

Artificial neural networks: Counter propagation network- architecture- functioning & characteristics of counter- Propagation network-Hopfield/ Recurrent network- configuration-stability constraints-associative memory- and characteristics. Adaptive Resonance Theory-Architecture- classifications-Implementation and training-Associative Memory

Self-study component: Limitations and applications- Hopfield v/s Boltzman machine

10 Hours

Unit-3

Fuzzy logic system: Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control- Fuzzification-inferencing and defuzzification- -Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system

Self-study component: Fuzzy Knowledge and Rule Bases

10 Hours

Unit-4

Genetic algorithm : Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm-Concept on some other search techniques like tabu search.

Self-study component: Ant colony search techniques for solving optimization problems.

10 Hours

Unit-5

Applications: GA application to power system optimization problem- Case studies: Identification and control of linear and nonlinear dynamic systems using Matlab-Neural Network toolbox. Stability analysis of Neural Network interconnection systems-Implementation of fuzzy logic controller using Matlab fuzzy logic toolbox

Self-study component: Stability analysis of fuzzy control systems.

Text Books:

1. S.N. Sivanandam& S.N. Deepa, *Principles of Soft Computing*, Wiley Publications, 2nd Edition, 2011.
2. S, Rajasekaran& G.A. VijayalakshmiPai, *Neural Networks,Fuzzy Logic & Genetic Algorithms, Synthesis & applications*, PHI Publication, 1st Edition, 2009.

Reference Books:

1. N.K.Bose, Ping Liang, *Neural Network fundamental with Graph, Algorithms & Applications*, TMH, 1st Edition, 1998.
2. Bart Kosko, *Neural Network & Fuzzy System*, PHI Publication, 1st Edition, 2009.
3. Rich E, Knight K, *Artificial Intelligence*, TMH, 3rd Edition, 2012.
4. George J Klir, Bo Yuan, *Fuzzy sets & Fuzzy Logic*,Theory& Applications, PHI Publication, 1st Edition, 2009.
5. Martin T Hagen, *Neural Network Design*, Nelson Candad, 2nd Edition, 2008

Course Outcomes

After learning all the units of the course, the student is able to

1. **Understand and apply** feed forward neural networks
2. **Develop** feedback neural networks
3. **Identify** fuzziness involved in various systems
4. **Apply** ideas about genetic algorithm
5. **Apply** FLC and NN toolbox

CO-PO mapping

Semester :6th		Course code : P17CS652					Title : Soft Computing Techniques								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	**Understand and apply** feed forward neural networks		2												2
CO2	**Develop** feedback neural networks	2	3												3
CO3	**Identify** fuzziness involved in various systems	2	3												3
CO4	**Apply** ideas about genetic algorithm.	2	3												3
CO5	**Apply** FLC and NN toolbox.	2	3												3
CO		**2**	**2.8**												**2.8**

Course Title : Pattern Recognition			
Course Code: P17CS653	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives

1. Introduce to fundamental concept, statistical approach to pattern recognition.
2. Learn how to design optimal classifier and focus on related techniques of parameter estimation.
3. Know about non parametric procedures used with arbitrary distribution, various procedures for determining discriminant function.
4. To learn unsupervised procedure that used unlabelled sample.
5. Introduce to various methodologies for identification and verification of a person

Course Content

Unit 1

Introduction and Bayesian Decision Theory: Machine perception, an example; Pattern Recognition System; The Design Cycle; Learning and Adaptation. Introduction to Bayesian Decision Theory; Continuous Features, Minimum error rate, classification, classifiers, discriminant functions, and decision surfaces; The normal density;
Self-study component: Discriminant functions for the normal density.

10 Hours

Unit 2

Maximum-likelihood, Bayesian Parameter Estimation and Non-parametric Techniques: Introduction to Maximum-likelihood estimation; Bayesian Estimation; Bayesian parameter estimation: Gaussian Case, general theory; Hidden Markov Models.
Introduction to Non Parametric Techniques; Density Estimation; Parzen windows; kn – Nearest- Neighbor Estimation; The Nearest- Neighbor Rule;
Self-study component: Metrics and Nearest-Neighbor Classification.

12 Hours

Unit 3

Linear Discriminant Functions: Introduction; Linear Discriminant Functions and Decision Surfaces; Generalized Linear Discriminant Functions; The Two-Category Linearly Separable case; Minimizing the Perception Criterion Functions; Relaxation Procedures; Non-separable Behavior; Minimum Squared-Error procedures;
Self-study component: The Ho-Kashyap procedures.

10 Hours

Unit 4

Unsupervised Learning and Clustering: Introduction; Mixture Densities and Identifiability; Maximum-Likelihood Estimates; Application to Normal Mixtures; Unsupervised Bayesian Learning; Data Description and Clustering;
Self-study component: Fuzzy k-means clustering and Criterion Functions for Clustering.

10 Hours

Unit 5

Introduction to Biometrics: Biometric methodologies: finger prints, hand geometry, facial recognition, Iris scanning, identification & verification – the distinction, performance criterion.
Self-study component: Retina scanning.

10 Hours

Text Book:

1. Richard O.Duda, Peter E.Hart, David G. Stork, "Pattern Classification", John Wiley publication, 2nd edition, 2001.

Reference Books:

1. Robert Schalkoff, "Pattern Recognition: Statistical, Structural and Neural pproaches", John Wiley & Sons, Inc.1992.
2. Christopher M. Bishop ,"Pattern Recognition and Machine Learning", Springer publication, 2006
3. K.Jain, R.Bolle, S.Pankanti, "Biometric: Personal Identification in network society", Kluwer academic publishers, 1999.

Course Outcomes

After completing this course, students should be able to:

1. **Classify** patterns using Bayesian Decision Theory.
2. **Classify** patterns using Parametric and Non-Parametric techniques.
3. **Perform** Subspace analysis for classification problems and compare with other classification algorithms.
4. **Choose** between single Gaussian and mixture models for classification based on the applications.
5. **Understand** various biometric technologies and its merits and demerits

CO-PO Mapping

Semester : 6th	Course code : P17CS653						Title : Pattern Recognition								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO 653.1	**Classify** patterns using Bayesian Decision Theory.		2				2	3	1	2		2		2	
CO 653.2	**Classify** patterns using Parametric and Non-Parametric techniques		3	1			2	2	1	2		2		2	
CO 653.3	**Perform** Subspace analysis for classification problems and compare with other classification algorithms.		3	2		2	2	3	1	2		2	1	2	
CO 653.4	**Choose** between single Gaussian and mixture models for classification based on the applications.				3		2	1		2				2	
CO 653.5	**Understand** various biometric technologies and its merits and demerits.		3		2	2	2	2		2		2	2	2	
C653			**2.7**	**1.5**	**2.5**	**2**	**2**	**2.2**	**1**	**2**		**2**	**1.5**	**2**	

Course Title : Software Agents			
Course Code: P17CS654	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Course Learning Objectives (CLOs)

This course aims to

1. **Provide** sufficient in depth knowledge in Software agents.
2. **Understand** the how software agents reduce information overhead, gain knowledge in use of software agents for cooperative learning and personal assistance
3. **Demonstrate** Software Agent can communicate and share knowledge using agent communication language,
4. **Develop** an agent interpreter and intelligent agent
5. **Understand** the concept of mobile technology and mobile agents and its security.

Relevance of the Course: The course gives depth knowledge in software agents. These software agents reduce information overhead, gain knowledge in use of software agents for cooperative learning and personal assistance. To know how agent can communicate and share knowledge using agent communication language, gain knowledge in design of an agent interpreter and intelligent agent. To understand the concept of mobile technology and mobile agents and its security.

Course Content

Unit-1

Agent and User Experience: Agent characteristics- object Vs agent. Agent types- Interacting with Agents - Agent from Direct Manipulation to Delegation - Interface Agent, Metaphor with Character – Designing Agents –problem solving agent, rational agent.

Self-study component: Direct Manipulation versus Agent Path to Predictable

12 Hours

Unit-2

Agents for Learning And Assistance : Agents for Information Sharing and Coordination - Agents that Reduce Work Information Overhead - Agents without Programming Language - Life like Computer character - S/W Agents for cooperative Learning – Multiple Reasoning agents –M system. Learning agents: computational architectures for learning agents; evolution, adaptation

Self-study component: Multi-agent learning

10 Hours

Unit-3

Agent Communication And Collaboration: Overview of Agent Oriented Programming - Agent Communication Language – KQML-Per formatives.. Virtual agents: agents in games and virtual environments; companion and coaching agents; modeling personality, emotions; multimodal interaction; verbal and non-verbal expressiveness.

Self-study component: Agent Based Framework of Interoperability

10 Hours

Unit-4

Agent Architecture: Strategies for agent design. Agent interpreter- BDI architecture. Architecture of Intelligent Agents. Agents for Information Gathering - Open Agent Architecture - Communicative Action for Artificial Agent.

Self-study component: Agent societies and societal issues

10 Hours

Unit-5

Mobile Agents: Mobile agent paradigm - Mobile agent concepts -Mobile agent technology – programming mobile agents –. Mobile agent security- trust, reliability and reputation.
Self-study component: Application of mobile agents- Teleshopping

10 Hours

Text Book:

1. Jeffrey M.Bradshaw," Software Agents ", MIT Press 2000, Pearson Indian Reprint 2010

Reference Books:

1. Lin, Fuhua Oscar (Ed.), "Designing Distributed Learning Environments with Intelligent Software Agents", Information Science Publishing, 2004
2. Russel &Norvig, " Artificial Intelligence: A Modern Approach ", Prentice Hall, 2nd Edition, 2002
3. Murch Richard, Johnson Tony 'Intelligent Software Agents, 'Prentice Hall, 1998.
4. Knapik, Michael and Jay Johnson 'Developing Intelligent Agents for Distributed Systems: Exploring Architecture, Technologies, and Applications', McGraw-Hill.1998
5. William R. Cockayne, Michael Zyda, "Mobile Agents", Prentice Hall, 1998

Course Outcomes

After learning all the units of the course, the student is able to

1. **Analyze** how agents are used to enhance learning and provide intelligent assistance to users.
2. **Analyze** about agent–to–agent communication and the use of agents to provide intelligent interoperability in distributed systems and the Internet
3. **Implement** how agents are used to enhance learning and provide intelligent assistance to users.
4. **Demonstrate** the concept of mobile technology
5. **Develop** mobile agents and its security

CO-PO mapping

Semester : 6th		Course code : P17CS654					Title : Software Agents								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO1	**Analyze** how agents are used to enhance learning and provide intelligent assistance to users.	2	2	2		2				2					3
CO2	**Analyze** about agent–to–agent communication and the use of agents to provide intelligent interoperability in distributed systems and the Internet	2	2	2		2				2					3
CO3	**Implement** how agents are used to enhance learning and provide intelligent assistance to users.	2	2	2		2				2					3
CO4	**Demonstrate** the concept of mobile technology	**3**	**3**	**2**						**2**					**3**
CO5	**Develop** mobile agents and its security.	**2**	**2**	**3**		**3**				**2**					3
CO		**2.2**	**2.2**	**2.2**		**1.8**				**2**					3

ELECTIVE-III

Course Title : Wireless Networks and Mobile Computing			
Course Code : P17CS661	**Semester : Vl**	**L :T:P:H : 4:0:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		**Weightage: CIE:50; SEE:50**	

Course Content

Unit-1

Mobile Communication, Mobile Computing, Mobile Computing Architecture, Mobile Devices Mobile System Networks, Data Dissemination, Mobility Management, Security Cellular Networks and Frequency Reuse, Mobile Smartphone, Smart Mobiles, and Systems Handheld Pocket Computers.

Self-Study Component: Handheld Devices, Smart Systems, Limitations of Mobile Devices Automotive Systems.

10 Hours

Unit-2

GSM-Services and System Architecture, Radio Interfaces of GSM, Protocols of GSM Localization, Call Handling Handover, Security, New Data Services, General Packet Radio Service High-speed Circuit Switched Data, DECT, Modulation, Multiplexing, Controlling the Medium Access Spread Spectrum, Frequency Hopping Spread Spectrum (FHSS),Coding Methods, Code Division Multiple Access, IMT-2000 3G Wireless Communication Standards, WCDMA 3G Communications Standards ,CDMMA2000 3G Communication Standards, Imode, OFDM, High Speed Packet Access (HSPA) 3G Network Long-term Evolution.

Self-Study Component: WiMaxRel 1.0 IEEE 802.16e, Broadband Wireless Access, 4G Networks, Mobile Satellite Communication Networks.

11 Hours

Unit-3

IP and Mobile IP Network Layers, Packet Delivery and Handover Management Location Management, Registration, Tunnelling and Encapsulation, Route Optimization Dynamic Host Configuration Protocol, VoIP, IPsec Conventional TCP/IP Transport Layer Protocols, Indirect TCP, Snooping TCP Mobile TCP.

Self-Study Component: Other Methods of Mobile TCP-layer Transmission,TCP over 2.5G/3G Mobile Networks.

10 Hours

Unit-4

Data Organization, Database Transactional Models – ACID Rules, Query Processing Data Recovery Process, Database Hoarding Techniques , Data Caching, Client-Server Computing for Mobile Computing and Adaptation. Adaptation Software for Mobile Computing.

Self-Study Component: Power-Aware Mobile Computing, Context-aware Mobile Computing

10 Hours

Unit-5

Communication Asymmetry, Classification of Data-delivery Mechanisms, Data Dissemination Broadcast Models, Selective Tuning and Indexing techniques, Digital Audio Broadcasting (DAB), Digital Video Broadcasting Synchronization, Synchronization Software for Mobile Devices, Synchronization Software for Mobile Devices.

Self-Study Component: SyncML-Synchronization Language for Mobile Computing, Sync4J (Funambol),Synchronized Multimedia Markup Language (SMIL).

11 Hours

Text Books:

1. Raj kamal: Mobile Computing, 2nd Edition, Oxford University Press, 2007/2012
2. MartynMallik: Mobile and Wireless Design Essentials, Wiley India, 2003

Reference Books:

1. Ashok Talukder, RoopaYavagal, Hasan Ahmed: Mobile Computing, Technology, Applications and Service Creation, 2nd Edition, Tata McGraw Hill, 2010.
2. ItiSahaMisra: Wireless Communications and Networks, 3G and Beyond, Tata McGraw Hill, 2009.

CO-PO Mapping

Semester: 6th	Course code : P17CS661						Wireless Networks and Mobile Computing								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**
1	**Describe** mobile computing Architecture, components of mobile**.**	1		2	1										
2	**Analyze** different technologies of mobile computing.	2	2	3	2	2	2	2	2	2			2	2	2
3	**Describe** the working procedure of mobile computing.	2	2	3	2	2								2	2
4	**Analyze** the database involvement in mobile computing	2	2	3	2	2	2		2					2	2
5	**Describe** data delivery mechanisms in mobile devices	2	2	1	2	2									
		1.8	**2.0**	**2.4**	**1.8**	**2**	**2**	**2**	**2**	**2**			**2**	**2**	2

Course Title : Semantic Web Technologies			
Course Code : P17CS662	**Semester : Vl**	**L :T:P:H : 4:0:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		**Weightage: CIE:50; SEE:50**	

Course learning objectives:

1. Understand the fundamentals of Semantic Web technologies.
2. Understand the concepts of RDF and web ontology language (OWL).
3. Use ontology engineering approaches in semantic Web.
4. Understand the concepts of web ontology language for services
5. Understand the various applications of Semantic Web.

Course learning objectives:

1. Understand the rationale behind Semantic Web.
2. Design RDF and RDFS for Ontologies.
3. Understand and reflect on the principles of Ontology engineering.
4. Understand the concepts of web ontology language for services
5. Apply Semantic Web technologies to real world applications.

Course Content

Unit - 1

Introduction to semantic web: Thinking and Intelligent Web Applications, The Information Age, The World Wide Web, Limitations of Today's Web, The Next Generation Web, Why Intelligent ubiquitous devices improve productivity, Machine Intelligence, Artificial Intelligence, Ontology, Inference engines, Software Agents, Web Architecture and Business Logic, The Semantic Web, Berners-Lee www, The semantic web roadmap, logic on the semantic web.

Self-Learning Component: Comparison of web 1.0,web 2.0,web 3.0

10 Hours

Unit - 2

Resource Description Framework (RDF): HTML Language, XML Language, RDF Language, RDF Triple, Basic Elements, RDF Schema, RDF and RDFS layers, RDF and RDFS semantics , RDF and RDFS Limitations, XQuery: XML Query Language.

Web Ontology Language: Ontology Language, Ontology Language Requirements, Compatibility of OWL and RDF/RDFS, The OWL Language, Basic Elements, OWL Example: Compute Ontology, Ontology Example: Birthplace, Applying OWL, OWL Capabilities and Limitations.

Self-Learning Component: Problems on RDF and RDFS

10 Hours

Unit – 3

Ontology Engineering: Ontology Engineering, Constructing Ontology , Ontology Development Tools, Ontology "Spot" Example, Ontology Methods, Ontology Sharing and Merging, Ontology Libraries, Ontology Matching, Ontology Mapping, Ontology Mapping Tools. **Logic, Rules, and Inference:** logic and inference, monotonic and non monotonic rules, descriptive logic, inference engines, RDF inference engine

Self-Learning Component: Problems on RDF inference engine

. **11 Hours**

Unit-4

Web Ontology Language for Services: XML-based Web Services, Next Generation Web Services, Process Ontology, Process control ontology, Relationship between OWL-S and WSDL and SOAP, Creating an OWL-S Ontology for Web Services, Semantic web rule language

Semantic Tools: Semantic Tools, Ontology tools, Cerebra, Visual Ontology Modeler, SMORE, Drive, Semantic Web Services Tools.
Self-Learning Component: software tools in semantic web

. **11 Hours**

Unit-5

Semantic Web Applications: Semantic Web Applications, Semantic Web Services, Semantic Search, e-Learning, Semantic Bioinformatics, Enterprise Application Integration, Knowledge Base.
Semantic Search Technology: Search Engines, Semantic Search, Semantic Search Technology
Web Search Agents, Semantic Methods, Latent Semantic Index Search, TAP, Swoogle.
Self-Learning Component: E- learning

10 Hours

Text Book:
1. Thinking on the Web - Berners Lee, Godel and Turing, Wiley inter science, 2006.

Reference Books:
1. Semantic Web Technologies, Trends and Research in Ontology Based Systems.
2. Semantic Web and Semantic Web Services -Liyang Lu Chapman and Hall/CRC Publishers, (Taylor & Francis Group).
3. Programming the Semantic Web, T.Segaran, C.Evans, J.Taylor, O'Reilly.

Course Outcomes

At the end of the course the student should be able to
1. **State** the reason for the semantic web and its applicability
2. **Describ**e RDF and RDFS
3. **Understand and Describe** ontologies
4. **Apply** Semantic Web technologies to real world applications
5. **Implement** a group project leveraging semantic web techniques

CO-PO Mapping

Sem: 6th		**Course code : P15CS662**					**Title : Semantic Web Technologies**								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
C01	**State** the reason for the semantic web and its applicability	3	3	3	1					2		2	2		3
CO2	**Describe** RDF and RDFS	3	2	3	1					2		2	2		3
CO3	**Understand and Describ**e ontologies	3	3	3		2				2		2			3
CO4	**Apply** Semantic Web technologies to real world applications	2	2	2						2		2			2
CO5	**Implement** a group project leveraging semantic web techniques	2	1	1											2
		2.6	**2.2**	**2.4**	**1**	**2**				**2**		**2**	**2**		**2.6**

Course Title : Service Oriented Architecture			
Course Code: P17CS663	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Prerequisites: Student should have knowledge of basic SOFTWARE architecture, Web Service systems, java language and databases.

Course Learning Objectives (CLO's)

The course aims to:

1. Discuss the basic principles of service orientation.
2. Discuss the service oriented analysis techniques.
3. Describe technology underlying the service design.
4. Explain advanced concepts such as service composition, orchestration and Choreography.
5. Discuss about various WS-* specification standards.

Course Content

Unit-1

Roots of SOA – Characteristics of SOA -Anatomy of SOA- How components in an SOA interrelate – Principles of service orientation.

Self-study component: Comparing SOA to client-server and distributed internet architectures

10 Hours

Unit -2

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography- Service layer abstraction– Business Service Layer- Orchestration Service Layer**.**

Self-study component: Application Service Layer

12 Hours

Unit -3

Service oriented analysis – Business-centric SOA – Deriving business services- service modeling - Service Oriented Design – WSDL basics – SOAP basics – SOA composition guidelines, Application service design – Taskcentric

Business service design.

Self-study component: Entity-centric business service design

9 Hours

Unit -4

SOA platform basics – SOA support in J2EE – Java API for XML-based web services JAX-WS) - Java architecture for XML binding (JAXB) – Java API for XML Registries (JAXR) - Java API for XML based RPC (JAX-RPC), SOA support in .NET – Common Language Runtime - ASP.NET web forms - ASP. NET web services – Web Services Enhancements (WSE)

Self-study component: Web Services Interoperability Technologies (WSIT)

12 Hours

Unit -5

WS-BPEL basics – WS-Coordination overview - WS-Choreography, SSecurity

Self-study component: WS-Policy

9 Hours

Text Book:

1. Thomas Erl, "Service-Oriented Architecture: Concepts, Technology, and Design", Pearson Education, 2014.

Course Outcomes:

This course will enable students to:

1. Discuss the basic principles of service orientation.
2. Discuss the service oriented analysis techniques.
3. Describe technology underlying the service design.
4. Explain advanced concepts such as service composition, orchestration & choreography
5. Discuss about various WS-* specification standards.

CO-PO Mapping

Semester: 6	**Course code :P17CS663**			**Title : Service Oriented Architecture**											
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
C101.1	**Discuss** the basic principles of service orientation.	2												2	2
C101.2	**Discuss** the service oriented analysis techniques.	2	3											3	3
C101.3	**Design** technology underlying the service design.	2	3											3	3
C101.4	**Explain** advanced concepts such as service composition, orchestration and Choreography.	2	2	2										3	3
C101.5	**Describe** about various WS-* specification standards.	2	2	2										3	3
C101		**2**	**2.5**	**2**										**2.8**	**2.8**

Course Title : Internet of Things			
Course Code : P17CS664	**Semester : 6**	**L :T:P:H : 4:0:0:4**	**Credits: 3**
Contact Period: Lecture: 52 Hr, Exam: 3 Hr		**Weightage: CIE:50%, SEE:50%**	

Course Content

Unit-1

M2M to IoT-The Vision-Introduction, From M2M to IoT, M2M towards IoT-the global context.

Self-study component: A use case example, Differing Characteristics

10 Hours

Unit-2

M2M to IoT – A Market Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value chain and global information monopolies. **M2M to IoT-An Architectural Overview**– Building an architecture, Main design principles and needed capabilities.

Self-study component: An IoT architecture outline, standards considerations.

10 Hours

Unit-3

M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics.

Self-study component: Knowledge Management.

11 Hours

Unit-4

IoT Architecture-State of the Art – Introduction, State of the art, **Architecture Reference Model-** Introduction, Reference Model and architecture.

Self-study component: IoT reference Model.

10 Hours

Unit-5

IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views. **Real-World Design Constraints-** Introduction, Technical Design constraints-hardware is popular again, Data representation and visualization, Interaction and remote control. **Industrial Automation-** Service-oriented architecture-based device integration, SOCRADES: realizing the enterprise integrated Web of Things, IMC-AESOP: from the Web of Things to the Cloud of Things, **Commercial Building Automation-** Introduction, Case study: phase one-commercial building automation today,

Self-study component: Case study: phase two- commercial building automation in the future.

11 Hours

Textbook:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, **"From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence",** 1st Edition, Academic Press, 2014.

Reference Books:

1. Vijay Madisetti and ArshdeepBahga, **"Internet of Things (A Hands-on-Approach)",** 1st Edition, VPT, 2014.
2. Francis daCosta, **"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",** 1st Edition, Apress Publications, 2013

Course Outcomes:

At the end of the course the student will be able to:

1. Understand the vision of IoT from a global context.
2. Determine the Market perspective of IoT.
3. Use of Devices, Gateways and Data Management in IoT.
4. Building state of the art architecture in IoT.
5. Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints.

CO-PO Mapping

Semester : 6	Course code : P17CS664						Title : Internet of Things								
CO	**Statement**	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO-1	Understand the vision of IoT from a global context	2	1	1		1								1	1
CO 2	Determine the Market perspective of IoT	2	1	1		1								1	1
CO-2	Use of Devices, Gateways and Data Management in IoT	2	2	2		1								1	1
CO-3	Building state of the art architecture in IoT	2	1	3										1	1
CO-4	Application of IoT in Industrial and Commercial Building Automation and Real World Design Constraints	2	2	2		1								1	1

Course Title : Aptitude and Reasoning Development - EXPERT (ARDE)			
Course Code : P17HU610	Semester : 6	L:T:P:H 0:0:2:2	Credits: 1
Contact Period: Lecture: 32 Hr, Exam: 3 Hr	Weightage: CIE:50%; SEE:50%		
Prerequisites: Number system, Concept of percentage, Analytical reasoning-2.			

Course Learning Objectives (CLOS)

This course aims to

1. Explain different types of functions, representation of different functions on the graphs.
2. Describe the properties of quadratic equations and application of quadratic equations.
3. Demonstrates the principle of counting.
4. Differentiates between permutation and combination and solve problems conceptually.
5. Predict the probabilities in different scenarios and its application in our day-to-day life.
6. Evaluate the cause and effect of the statements logically.
7. Recognize different ways in which a statement can be strengthened or weakened.
8. Explain the criticality of data sufficiency chapter, universal methodology to solve any problem.
9. Analyse the data in a bar graph, pie chart and tabular column and line graph and the combination of these graphs.
10. Compare the data in different format and understand the difference between them

Course Content

Unit-1

Functions and Quadratic equations:

Functions: Basic methods of representing functions– Analytical representation, tabular representation, graphical representation of functions. Even and odd functions, Inverse of a function, shifting of graph. Representation of standard set of equations. Methodology to tackle inverse functions. Graphical process for solving inequalities, graphical view of logarithmic function.

Quadratic equations: Theory, properties of quadratic equations and their roots, the sign of quadratic equation, Equations in more than one variable. Simultaneous equations, number of solutions of the simultaneous equations.

6 Hours

Unit-2

Permutation and Combination: Understanding the difference between the permutation and combination, Rules of Counting-rule of addition, rule of multiplication, factorial function, Concept of step arrangement, Permutation of things when some of them are identical, Concept of 2^n, Arrangement in a circle.

Probability: Single event probability, multi event probability, independent events and dependent events, mutually exclusive events, non-mutually exclusive events, combination method for finding the outcomes.

8 Hours

Unit-3

Analytical reasoning 3: Punchline: Introduction, format of the problem, an analysis, Does a suggested statement qualify as a punchline? If a given statement fits as a punchline, what is its idea or wavelength? The complete method of solving a punchline problem, Solved examples, conclusion, Sample company questions.

Strengthening and weakening arguments: Format of the problem, an analysis, Suggested methods, solved examples, conclusion, sample company questions.

Cause and Effect: Cause and Effect—A theoretical discussion, Immediate cause, Principal cause, A quick check– Cause always antecedent. The strategy for solution.

6 Hours

Unit-4

Data Sufficiency: Introduction, answer choices in data sufficiency, tips to solve data sufficiency problems, directions of questions, classification of sections in data sufficiency– Number system, Algebra, series and sequence, logical, geometry and mensuration, arithmetic.

6 Hours

Unit-5

Data Interpretation: Approach to interpretation - simple arithmetic, rules for comparing fractions, Calculating (approximation) fractions, short cut ways to find the percentages, Classification of data– Tables, Bar graph, line graph, Cumulative bar graph, Pie graph, Combination of graphs. Combination of table and graphs

6 Hours

Reference Books:

1. **"The Trachtenberg speed system of basic mathematics**, published by Rupa publications.
2. **CAT Mathematics** by AbhijithGuha. Published by PHI learning private limited.
3. **Quantitative aptitude** by Dr. R. S Agarwal, published by S.Chand private limited.
4. **Verbal reasoning** by Dr. R. S Agarwal , published by S. Chand private limited.
5. **Quantitative aptitude** for CAT by Arun Sharma, published by McGraw Hill publication.
6. **Analytical reasoning** by M.K Pandey BSC PUBLISHING.CO.PVT.LTD

Course Outcomes (CO)

After learning all the units of the course, the student is able to:

1. Graphically represent the functions and analyze it. L5
2. Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them. L6
3. Effective solve the problems of permutation and combination. L4
4. Predict different possibilities by the principle of probability. L3
5. Interpret the data given in the graphical format and infer the results. L5
6. Analyze the statement critically and solve the questions from verbal logic section. L5

A. Course Articulation Matrix (CAM)															
Course Outcome (CO)	**Program Outcome (ABET/NBA-(3a-k))**														
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Graphically represent the functions and analyze it.	L5	2	-	-	-	2	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	3	-	-	-	2	-	-	-	2	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	3	-	-	-	-	-	-	-	2	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	2	-	-	-	-	-	-	-	-	-	-	-	-	-
L- Low, M- Moderate, H-High															