Syllabus

(With effect from 2015-2016 Academic year)

ಪಠ್ಯಕ್ರಮ

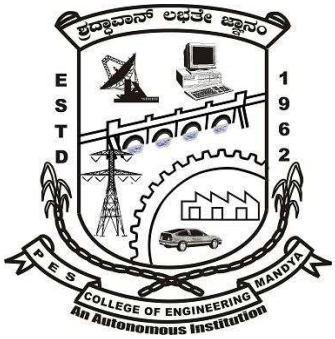
(ಶೈಕ್ಷಣಿಕವರ್ಷ 2015–16)

V & VI Semester

Bachelor Degree
in
Computer Science and Engineering

Out Come Based Education with Choice Based Credit System

ಫಲಿತಾಂಶ ಆಧಾರಿತ ಶಿಕ್ಷಣ ಹಾಗೂ ಐಚ್ಛಿಕ ವಿಷಯಾಧಾರಿತ ಗಳಿಕೆ ಪದ್ಧತಿ



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)

Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

Preface

PES College of Engineering, Mandya, started in the year 1962, has become autonomous in the academic year 2008-09. Since, then it has been doing the academic and examination activities successfully. The college is running Eight undergraduate and Eight Postgraduate programs. It consists of Six M.Tech programs, which are affiliated to VTU. Other postgraduate programs are MBA and MCA.

India has recently become a Permanent Member by signing 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 such as Taiwan, Hong Kong, Ireland, Korea, Malaysia, New Zealand, Russia, Singapore, South Africa, Turkey, Australia, Canada and Japan. Among other signatories to the international agreement are the US and the UK. Implementation of Outcome Based Education (OBE) has been the core issue for enabling the equivalence and of Indian degrees and their mobility across the countries.

Our Higher Educational Institution has adopted the CBCS based semester structure with OBE scheme and grading system.

The credit based OBE semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching.

The OBE, emphasize setting clear standards for observable, measurable outcomes of programs in stages. There lies a shift in thinking, teaching and learning processes moving towards Students Centric from Teacher Centric education. OBE standards focus on mathematics, language, science, attitudes, social skills & moral values.

The key features which may be used to judge, if a system has implemented an outcome based education system is mainly Standard based assessments that determines whether students have achieved the stated standard. Assessments may take any form, so long as the process actually measure whether the student knows the required information or can perform the required task. Outcome based education is a commitment that all students of all groups will ultimately reach the same minimum standards. Outcome Based Education is a method or means which begins with the end in mind and constantly emphasizes continuous improvement.

Choice Based Credit System (CBCS) provides choice for students to select from the prescribed courses (core, Foundation, Foundation Elective, elective, open elective and minor or soft skill 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 to learning which enables integration of concepts, theories, techniques, and, perspectives from two or more disciplines to advance fundamental understanding or to solve problems whose solutions are beyond the scope of a single discipline. These greatly enhance the skill/employability of students.

In order to increase the Industry/Corporate readiness, many Soft Skills and Personality Development modules have been added to the existing curriculum of the academic year 2015-16. Industry Interactions have been made compulsory to enhance the field experience. In order to enhance creativity and innovation Mini Project and Industrial visit & Interaction are included in all undergraduate programs.

Sri. B.Dinesh Prabhu
Deputy Dean (Academic)
Associate Professor
Dept. of Automobile Engg.

Dr.P S Puttaswamy
Dean (Academic)
Professor
Dept. of Electrical & Electronics Engg

PES College of Engineering, Mandya

The vision of the Institute is:

"PESCE shall be a leading institution imparting quality engineering and management education developing creative and socially responsible professionals."

Institute Mission in pursuance of its vision is:

- Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.
  (Required to be a leading institution)
- Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.
  (Required to provide quality engineering and management education)
- Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.
  (Required to produce socially responsible professionals)
- Promote research, product development and industry-institution interaction.
  (Required to produce creative professionals)

Department of Computer Science and Engineering

About the Department:

The Department of Computer Science and Engineering was established in 1983. The department offers B.E. program with an intake of 120 students, M.Tech. in Computer Science and Engineering with 18 students, M.Tech. in Computer Engineering with 24 students and also Ph.D. programme. Currently the strength of teaching faculty is 32 and that of non teaching staff is 14. The teacher - student ratio is 1:16. The department has a research centre under VTU and University of Mysore, with 2 research guides and 8 research students. During the last five years, the department has published 85 technical papers in international/national journals/conferences. So far, the department has organized four international and 8 national conferences. The department is equipped with all the required infrastructure, laboratories, class rooms, departmental library. The departments wish to achieve the mission of developing and nourishing computer science engineers through well-trained, committed and experienced faculty members. Faculty members of the departments are involved in research activities in different fields such as Image Processing, Pattern Recognition, Data Mining, Wireless Networks, Big Data Analytics and Computer Vision.

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 C S & E 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) of the UG in C S & E :

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.

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.**

Scheme of Teaching and Examination

V Semester B.E.(CS & E)

Sl. No	Course code	Course Title	Teaching Dept.	Hrs/Week	Total Credit	Examination Marks		
				L :T: P:H		CIE	SEE	Total
1	P15CS51	Operating System	CS	3:2:0:5	4	50	50	100
2	P15CS52	Database Management Systems	CS	4:0:0:4	4	50	50	100
3	P15CS53	Data Communications	CS	4:0:0:4	4	50	50	100
4	P15CS54	Software Engineering (Foundation course-I)	CS	4:0:0:4	4	50	50	100
5	P15CS55	Foundation Elective	CS	4:0:0:4	3	50	50	100
6	P15CS56	Elective-1	CS	4:0:0:4	3	50	50	100
7	P15CSL57	Microprocessor Lab	CS	0:1:2:3	1.5	50	50	100
8	P15CSL58	DBMS Lab	CS	0:1:2:3	1.5	50	50	100
9	P15CS59	Industry Visit & Interaction	CS	0:0:2:2	1	50	--	50
10	P15HU510	Aptitude and Reasoning Development – ADVANCED (ARDA)	HS&M	0:0:2:2	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	P15CS551	System Simulation & Modeling	P15CS561	Digital Image processing
2	P15CS552	Web Technologies	P15CS562	JAVA & J2EE
3	P15CS553	Machine Learning Techniques and Data Science	P15CS563	Storage Area Networks
4	P15CS554	Computer Graphics & Visualization	P15CS564	Artificial Intelligence

VI Semester B.E.(CS & E)

Sl. No	Course code	Course Title	Teaching Dept.	Hrs/Week	Total Credit	Examination Marks		
				L :T: P:H		CIE	SEE	Total
1	P15CS61	Entrepreneurship Management & IPR	CS	4:0:0:4	4	50	50	100
2	P15CS62	Advanced Computer Architecture	CS	4:0:0:4	4	50	50	100
3	P15CS63	Compiler Design	CS	4:0:0:4	4	50	50	100
4	P15CS64	Computer Networks (FC-II)	CS	3:1:0:5	4	50	50	100
5	P15CS65	Elective-II	CS	4:0:0:4	3	50	50	100
6	P15CS66	Elective-III	CS	4:0:0:4	3	50	50	100
7	P15CSL67	Networks Lab	CS	0:1:2:3	1.5	50	50	100
8	P15CSL68	Operating System & Compiler Design Lab	CS	0:1:2:3	1.5	50	50	100
9	P15CS69	Mini Project	CS	0:0:2:2	1	50	--	50
10	P15HU610	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	P15CS651	Client Server Programming	P15CS661	Wireless Networks
2	P15CS652	Soft Computing Technique	P15CS662	Semantic Web Technologies
3	P15CS653	Pattern Recognition	P15CS663	Service Oriented Architecture
4	P15CS654	Software Agents	P15CS664	Data Warehousing & Mining

Course Title : Operating System			
Course Code: P15CS51	**Semester : V**	**L:T:P: H - 3 : 2 : 0 : 5**	**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 organization, Computer System architecture, Operating System structure, 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 design and implementation, Operating System structure, Virtual machines, System boot.

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, threading issues.

Process Scheduling: Basic concepts, Scheduling criteria, Scheduling algorithms, Multiple-Processor scheduling, thread scheduling.

. **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.

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, Thrashing.

Protection: Goals of protection, Principles of protection, Domain of protection, Access matrix, Implementation of access matrix, Access control, Revocation of access rights.

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, Swap space management.

Case Study - Linux System : Design Principles , kernel modules , Process management , Scheduling , Memory Management , File System.

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 : P15CS51					Title : Operating system								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**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: P15CS52	**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 un structured 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, 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 : JOIN and DIVISION; Additional Relational Operations; Examples of Queries in Relational Algebra; Relational Database Design Using ER- to-Relational Mapping.

10 Hours

Unit-3

STRUCTURED QUERY LANGAUGE

SQL Data Definition and Data Types; Specifying basic constraints in SQL; Basic Retrieval Queries in SQL, INSERT, DELETE, and UPDATE Statements in SQL, 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.

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.

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: Two-phase locking techniques for concurrency control; 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

10 Hours

Text Books:

1. **Fundamentals of Database Systems –** Elmasri and Navathe, 6th Edition, Addison-Wesley, 2011

Reference Books:

1. **Data Base System Concepts** – Silberschatz, Korth and Sudharshan, 5th Edition, Mc-GrawHill, 2006.
2. **An Introduction to Database Systems** – C.J. Date, A. Kannan, S.Swamynatham, 8th Edition, Pearson Education, 2006.
3. **Database Management Systems** – Raghu Ramakrishnan and Johannes Gehrke – 3rd Edition, 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 : P15CS52					**Title : Database Management System**								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**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 concurrency 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 : Data Communications			
Course Code: P15CS53	**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

The students should be able to

1. Understand the properties of digital and analog signals, functionality of different layers in OSI and TCP/IP network models and the factors which impact performance of data communication systems
2. Understand the analog and digital transmission, properties of communication medias,and the concept of multiplexing of data on common communication channel
3. Understand different switching circuits, link layer addressing and exemplifythe different coding methods and error detection and correction methods for digital data.
4. Understand data link protocols and different media access control
5. Understand the architecture of wired and wireless Local Area Networks (LANs).

Course content

UNIT – 1

Introduction: Data Communications, Networks, Network Types, Internet History, Standards and Administration.
Network models: Protocol Layering, TCP/IP Protocol Suite, The OSI Model.
Introduction to physical layer: Data And Signals, Periodic Analog Signals, Digital Signals, Transmission Impairment, Data Rate Limits, Performance.

11 Hours

UNIT – 2

Digital transmission: Digital-To-Digital Conversion, Analog-To-Digital Conversion, Transmission Modes.
Analog transmission: Digital-To-Analog Conversion, Analog-To-Analog Conversion.
Bandwidth utilization: Multiplexing And Spectrum Spreading: Multiplexing, Spread Spectrum.

11 Hours

UNIT – 3

Transmission media: Introduction, Guided Media, Unguided Media: Wireless.
Switching: Introduction, Circuit-Switched Networks, Packet Switching, Structure Of A Switch.
Introduction to data-link layer: Introduction, Link-Layer Addressing.

10 Hours

UNIT – 4

Error detection and correction: Introduction, Block Coding, Cyclic Codes, Checksum, Forward Error Correction.
Data link control (DLC):DLC Services, Data-Link Layer Protocols, HDLC, Point-To-Point Protocol (PPP).
Media access control (MAC): Random Access, Controlled Access, Channelization.

10 Hours

UNIT – 5

Wired LANs: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Gigabit Ethernet, 10 Gigabit Ethernet.
Other wired networks: Telephone Networks, Cable Networks, Sonet, ATM.
Wireless LANs: Introduction, IEEE 802.11, Bluetooth.

10 Hours

Text Books:

1. Data Communication and Networking, Behrouz A.Forouzan**,** McGraw Hill, 5th Edition, 2013.

Reference Books:

1. Computer Networks, Tanenbaum, 5th Edition, Pearson Education/PHI, 2011.
2. Communication Networks-Fundamental Concepts and key architectures, Alberto Leon-Garcia and Indra Widjaja, Tata Mc-Graw-Hill 2nd Edition, Pearson Education, 2014

Course Outcomes

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

1. **CO-1: Describe** different network models and **calculate** the performance of the Network.
2. **CO-2: Select** encoding scheme, multiplexing methods and suitable media for data transmission.
3. **CO-3: Describe** different switching circuits, link addressing and **apply** different error detection and correction methods for digital data.
4. **CO-4: Differentiate** different data link protocols and **select** suitable media access control protocol for data transmission.
5. **CO-5: Explain** the architecture of wired and wireless Local Area Networks (LANs).

CO-PO mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1		3	3									2	3	
CO2			3	2								2	2	
CO3		3	3									2	3	
CO4			3									2	2	
CO5		3	2									2	2	
AVG		**3**	**2.8**	**2**								**2**	**2.4**	

Course Title : Software Engineering (Foundation Course-1)			
Course Code: P15CS54	**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.

. 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.

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

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.

. 10 Hours

Unit – 5

Project management: Risk management, Managing people, Teamwork.

Configuration management: Change management, Version management System building, 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,
2. McGraw-Hill, 2007.
3. **Software Engineering Theory and Practice -** Shari Lawrence Pfleeger, Joanne M.
4. Atlee, 3rd Edition, Pearson Education, 2006.
5. **Software Engineering Principles and Practice –** Waman S Jawadekar, Tata McGraw Hill, 2004
6. **Software Engineering** – Pankaj Jalote, 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

Sem: 5th		**Course code : P15CS54**					**Title : Software Engineering**								
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**
CO605.1	**Explore** the various types of software process.	3	2	1	1		1	1						2	
CO605.2	**Elaborate** the importance of software development.	3	2	2	1	2	1		1				1	2	
CO605.3	**Asses** the significance of software engineering	2	2	2		1			1	1				2	
CO605.4	**Compare** different Software Development methods.	2	2	3	1			1		1				2	
CO605.5	**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: P15CS551	**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. Analysing 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; Types of Models; Discrete-Event System Simulation; Steps in a Simulation Study.

10 Hours

UNIT – 2

Random-Number Generation

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

Random- Variates Generation

Inverse transform technique: Acceptance-Rejection technique.

12 Hours

UNIT – 3

Queuing Models

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

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, K-S Test.

10 Hours

UNIT – 5

Verification and Validation

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

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.

10 Hours

Text Book:

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

Reference Books:

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. Identify and formulate simulation model using the engineering knowledge for a given problem.
2. Generate and test random number variates and apply them to develop simulation models.
3. Analyze and develop methods to simulate any discrete system using queuing systems - Be able to work effectively with others
4. Design an input model for a given simulation system
5. Verify, Validate and Perform output analysis of a simulation model

Course Outcome (CO)	Program Outcome													
	PO 1	PO 2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
Identify and formulate simulation model using the engineering knowledge for a given problem.	2	2	-	-	-	-	-	-	-	-	-	-	2	-
Generate and test random number variates and apply them to develop simulation models.	2	2	-	-	-	-	-	-	-	-	-	-	2	-
Analyze and develop methods to simulate any discrete system using queuing systems-Be able to work effectively with others	2	2	3	-	-	-	-	-	-	-	-	-	-	2
Design an input model for a given simulation system	2	2	2	-	-	-	-	-	-	-	-	-	2	-
Verify, Validate and Perform output analysis of a simulation model	2	2	2	-	-	-	-	-	-	-	-	-	2	-

1 – Low, 2 – Moderate and 3 – High

Course Title : Web Technologies			
Course Code: P15CS552	**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, Security, The Web Programmers Toolbox.

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.

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, Pattern matching using regular expressions, Errors in scripts, Examples.

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; 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, Cookies, Session tracking

11 Hours

UNIT-5

Introduction to Rails

Overview of Rails, Document requests, processing forms, Rails applications with databases,

Introduction to Ajax

Overview of Ajax, Basics of Ajax, Rails with Ajax

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** – Xue Bai 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

Sem: 5th		Course code : P13CS552					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 : Machine Learning Techniques and Data Science			
Course Code: P15CS553	**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. To understand the basic concepts of learning and decision trees.
2. To understand the neural networks and genetic algorithms
3. To understand the Bayesian techniques
4. To understand the instant based learning
5. To understand the analytical learning and reinforced learning

UNIT - 1

INTRODUCTION, CONCEPT LEARNING AND DECISION TREES

Learning Problems – Designing Learning systems, Perspectives and Issues – Concept Learning – Version Spaces and Candidate Elimination Algorithm – Inductive bias – Decision Tree learning – Representation – Algorithm – Heuristic Space Search.

10 Hours

UNIT - 2

NEURAL NETWORKS AND GENETIC ALGORITHMS

Neural Network Representation – Problems – Perceptrons – Multilayer Networks and Back Propagation Algorithms – Advanced Topics – Genetic Algorithms – Hypothesis Space Search – Genetic Programming – Models of Evolution and Learning.

10 Hours

UNIT - 3

BAYESIAN AND COMPUTATIONAL LEARNING

Bayes Theorem – Concept Learning – Maximum Likelihood – Minimum Description Length Principle – Bayes Optimal Classifier – Gibbs Algorithm – Naïve Bayes Classifier – Bayesian Belief Network – EM Algorithm – Probably Learning – Sample Complexity for Finite and Infinite Hypothesis Spaces – Mistake Bound Model.

10 Hours

UNIT - 4

INSTANT BASED LEARNING AND LEARNING SET OF RULES

K- Nearest Neighbor Learning – Locally Weighted Regression – Radial Basis Functions – Case-Based Reasoning – Sequential Covering Algorithms – Learning Rule Sets – Learning First Order Rules – Learning Sets of First Order Rules – Induction as Inverted Deduction – Inverting Resolution

10 Hours

UNIT - 5

ANALYTICAL LEARNING AND REINFORCED LEARNING

Perfect Domain Theories – Explanation Based Learning – Inductive-Analytical Approaches - FOCL Algorithm – Reinforcement Learning – Task – Q-Learning – Temporal Difference Learning

10 Hours

TEXT BOOK:

1. Tom M. Mitchell, “Machine Learning”, McGraw-Hill Education (Indian Ed), 2013.

REFERENCES:

1. Ethem Alpaydin,“Intd. to Machine Learning”, II Ed., PHI Learning Pvt.Ltd., 2013.
2. T. Hastie, R. Tibshirani, J. H. Friedman, “The Elements of Statistical Learning”, Springer; 1st edition, 2001.

COURSE OUTCOMES:

On Completion of the course, the students will be able to

1. CO-1: Choose the learning techniques with this basic knowledge.
2. CO-2: Apply effectively neural networks and genetic algorithms for appropriate applications.
3. CO-3: Apply Bayesian techniques and derive effectively learning rules.
4. CO-4: Explain the different machine learning techniques.
5. CO-5: Choose and differentiate reinforcement and analytical learning techniques

CO-PO Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1		3	3									2		3
CO2			3	2								2		2
CO3			3	2								2		3
CO4			3	2								2		2
CO5		3	2									2		2
AVG		**3**	**2.8**	**2**								**2**		**2.4**

Course Title : Computer Graphics & Visualization			
Course Code: P15CS554	**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 synthetic camera model, 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.

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. refer Book 1 Chapter 4: 4.1, 4.4)

11 Hours

Unit – 3

IMPLEMENTATION: Coordinate Reference Frames, Line Drawing Algorithms, Circle Generating Algorithms, Fill-Area Primitives, Polygon Fill Areas, OpenGL Polygon Fill Area Functions, 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.

11 Hours

Unit – 4

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

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, Cubic B-Splines, The Utah Teapot.

10 Hours

TEXT BOOK:

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 BOOK:

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
CO505.1	**Apply** the concepts of Application Programming Interface (API) based on graphics pipeline approach	3	1	1		3						2			2
CO505.2	**Develop** mathematical transformations for generating graphics images.	2	2	3		3						2			3
CO505.3	**Develop** rasterization and input interaction techniques	2	2	3		3						2			3
CO505.4	**Apply** different types of projection methods	3	2	2		3						2			2
CO505.5	**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-1

Course Title : Digital Image Processing			
Course Code: P15CS561	**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, Linear and Nonlinear Operations.

10 Hours

UNIT – 2

Image Enhancement in Spatial domain: Some Basic Gray Level Trans– formations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations.

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

11 Hours

UNIT – 3

Image Restoration: Model of image degradation/restoration process, 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

11 Hours

UNIT – 4

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

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

10 Hours

UNIT – 5

Morphological Image Processing: Dilation and Erosion, opening and closing, Some Morphological algorithms.

Image Segmentation

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

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 restoration n model and noise models.	2	2	2	2	2				1			1	2	1
C101.4	Apply the color 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: P15CS562	**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, Assigning object reference

variables, 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, Abstract classes, Using final with inheritance.

Interfaces and packages, Exception handling in Java.

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

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, The Console Class.

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.

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, rrays, 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, get Documentbase() and get Codebase().

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.

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, Metadata, Data types, Exceptions.

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

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, 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 Edition, Pearson Education, 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 : P15CS562					Title : JAVA & J2EE								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
CO5062.1	**Distinguish** between various object-oriented concepts.	2	3	-	-	-	-	-	-	-	-	-	-	3	-
CO5062.2	**Design** the solution using multithreading and generic classes.	2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5062.3	**Develop** applications using frameworks and applets with events handling.	2	2	3	-	-	-	-	-	-	-	-	-	3	-
CO5062.4	**Develop** programs using JDBC and Servlets.	2	1	1	-	-	-	-	-	-	-	-	-	2	-
CO5062.5	**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: P15CS563	**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.

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.

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.

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.

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.

10 Hours

Text Book:

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:

The students shall able 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.

CO-PO mapping

Sem : 5th		Course code : P15CS563					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**	**PSO1**	**PSO2**
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: P15CS564	**Semester : V**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Prerequisites

The basic knowledge of Computer Science is mandatory. The knowledge of Mathematics, Languages, Science, Mechanical or Electrical engineering is a plus

Course Learning Objectives

This course aims to

1. **Understand** strong foundation of fundamental concepts in Artificial Intelligence
2. **Demonstrate** basic exposition to the goals and methods of Artificial Intelligence
3. **Apply** these techniques in applications which involve perception, reasoning and learning

Relevance of the Course

1. The invention of computers or machines, their capability to perform various tasks went on growing exponentially. Humans have developed the power of computer systems in terms of their diverse working domains, their increasing speed, and reducing size with respect to time.
2. A branch of Computer Science named *Artificial Intelligence* pursues creating the computers or machines as intelligent as human beings
3. Artificial Intelligence is a way of making a computer, a computer-controlled robot, or a software think intelligently, in the similar manner the intelligent humans think.

Course Content

Unit-1

INTELLIGENT AGENTS AND SEARCHING METHODS

Artificial Intelligence: Introduction : What is AI; Foundations of Artificial Intelligence; History of Artificial Intelligence; The state of Art;

Intelligent Agents: Agent and Environments; Good Behavior; The Nature of Environments; The Structure of Agents;

Problem-solving: Problem-solving agent; searching for solution; Uniformed search strategies;

Informed Search and Exploration: Informed search strategies; Heuristic functions; Online Search agents and unknown environment;

Constraint Satisfaction problems: Constraint satisfaction problems; Backtracking search for CSPs;

Adversarial search: Games; optimal decisions in Games; Alpha-Beta pruning;

12 Hours

Unit-2

LOGIC

Logical Agents: Knowledge-based agents**;** The wumpus world; Logic; propositional logic; Reasoning patterns propositional logic; Effective propositional interference; Agent based on propositional logic;

First-Order Logic: Representation revisited; Syntax and semantics of first order logic; Knowledge engineering in first order logic;

Interference in First-Order Logic: Propositional verses first-order interference; Unification and lifting;

10 Hours

Unit-3

KNOWLEDGE REPRESENTATION AND PLANNING

Knowledge Representation: Ontological engineering; Categories and object; Action, situations and events; Mental events and mental objects; The internet shopping world; Reasoning system for categories; Reasoning with default information; Truth maintenance system;

Planning: The planning problems; Planning with state-space search; Planning graphs; Planning with propositional logic

10 Hours

Unit-4

UNCERTAINTY

Uncertainty: Acting under uncertainty; Interference using full joint distributions; Independence; Bayes's rile and its use;

Probabilistic Reasoning: Representing knowledge in an uncertain domain; The semantic of Bayesian networks; Efficient representation of conditional distribution; Exact interference in Bayesian network

10 Hours

Unit-5

LEARNING

Learning: Forms of learning**;** Inductive learning; Learning decision tree; Ensemble learning; Computational learning theory

10 Hours

Text Book:

1. Elaine Rich,Kevin Knight, Shivashanka B Nair:Artificial Intelligence, Tata CGraw Hill 3rd edition. 2013
2. Stuart Russel, Peter Norvig: Artificial Intelligence A Modern Approach, Pearson 3rd edition 2013.

References Books:

1. Elaine Rich, Kevin Knight, Shivashankar.B.Nair, "Artificial Intelligence", Tata Mc Graw Hill Publishing Company Limited. Third Edition, 2009.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Harcourt Asia Pvt. Ltd., 2000.
3. George F. Luger, "Artificial Intelligence-Structures and Strategies for Complex Problem Solving", Pearson Education / PHI, 2002.

Course Outcomes:

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

1. **Analyze** the modern view of AI as the study of agents that receive precepts from the environment and perform actions
2. **Demonstrate** awareness of informed search and exploration methods
3. **Demonstrate** about AI techniques for knowledge representation, planning and uncertainty management
4. **Develop** knowledge of decision making and learning methods
5. **Implement** the use of AI to solve English Communication problems

CO-PO Mapping

Sem : 5th		Course code : P15CS564					Title : Artificial Intelligence								
CO	**Statement**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
C01	**Analyze** the modern view of AI as the study of agents that receive precepts from the environment and perform actions	3												2	2
C02	**Demonstrate** awareness of informed search and exploration methods	2	3											3	3
C03	**Demonstrate** about AI techniques for knowledge representation, planning and uncertainty management	2	3											3	3
C04	**Develop** knowledge of decision making and learning methods	2	2	3										3	3
C05	**Implement** the use of AI to solve English Communication problems	2	2	3										3	3
C0		**2.2**	**2.5**	**3**										**2.8**	**2.8**

Course Title : Microprocessor lab.			
Course Code: P15CSL57	**Semester : V**	**L-T-P-H: 0:1.2:3**	**Credits: 1.5**
Contact Period : Practical : 3 Hrs/Week, Exam: 3Hrs		**Weightage :CIE:50% SEE:50%**	

Course objectives:

This course makes students focus on and should be able,

1. To learn assembly level programs of 8086 processor using different addressing modes and instructions.
2. To learn interfacing of external devices to 8086.
3. To learn the usage of DOS and BIOS interrupts.
4. Exposed to tools used to debug the program.

Course Content

1.) a.) Search a key element in a list of 'n'16-bit numbers using the *Binary Search algorithm.*

b.) Interface a logic controller to perform the conversion from hexadecimal to octal. Accept the number from the i/p port of logic controller and display output on the o/p port.

2.) a.) Write ALP macros :
i) To read a character from the key board in the module (1) (in a different file.)
ii) To display character in module (2) (from different file)
iii) Use the above two modules to read a string of characters from the key board terminated by the carriage return and print the string in the display in the next line.
b.) Write an assembly level program to accept three numbers from the logic controller and find the largest among them and display it on the logic controller.

3.) a.) Write an assembly level program to generate N prime numbers. Store the numbers starting from location 2000h.
b.) Write an assembly level program to perform BCD up-down counter (00-255).

4.) a.) Read your name from the keyboard and display it at a specified location on the screen in front of the message "What is your name?" You must clear the entire screen before display.
b.) Interface seven segment display and display the given message from right to left.

5.) a.) Write an assembly level program to read the string and convert lowercase to uppercase, uppercase to lowercase. Also find the frequency of occurrence of a given character in that string.
b.) Display messages 1234 and 5678 alternately with flickering effects on a 7-segment display interface for a suitable period of time.

6.) a.) Read two strings, store them in locations STR1 of data segment and STR2 of extra segment. Check whether they are equal or not and display appropriated messages. Also display the length of the stored strings.
b.) Interface seven segment display and display the given message from left to right.

7.) a.) Write an assembly level program to multiply two matrices.
b.) Drive a Stepper Motor interface to rotate the motor both in *clockwise direction and in anti clockwise direction* by N steps (N is specified through the keyboard). Introduce suitable delay between successive steps (Any arbitrary value for the delay may be assumed by the student).

8.) a.) Write an assembly level program to sort the elements by using bubble-sort method.
b.) S*can* a 8x3 keypad *for key closure* and to *store the code of the key pressed* in memory
location or display on screen. Also display key pressed value, row and column numbers.

9.) a.) Compute *nCr* using recursive procedure. Assume that 'n' and 'r' are non- negative integers.
b.) Drive an Elevator Interface in the following way :
i) Initially the elevator should be in the ground floor, with all requests in OFF state
ii)When a request is made from a floor, the elevator should move to that floor, service the request ,wait there for a couples of seconds, and then come down to ground floor and stop. If some request occur during up or coming down they should be ignored.

10.) a)Write an assembly level program to add N bytes of packed BCD numbers. Accept the BCD numbers from the key board. Display the result in BCD form.
b.)Write a program to accept two digit numbers from the keypad interface. Perform division/ multiplication.

11.) a) Generate the first 'n' *Fibonacci* numbers and store all the Fibonacci numbers starting at even address.
b) Interface DAC to 8086 and display sine waveform on CRO.

12.) a.) Write an assembly level program to multiply two 2 digit unpacked BCD number.
b.) Interface DAC to 8086 and display triangular waveform on CRO.

Course Outcomes

1. **Develop** programs using arithmetic , logical, data transfer , conditional instructions
2. **Develop** program using string instructions and DOS interrupts
3. **Develop** programs to interface processor with external devices using PPI(8255)

CO-PO mapping

Sem: 5th		**Course code : P15CSL57**					**Title : Microprocessor Lab.**								
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**
CO507.1	**Develop** programs using arithmetic , logical, data transfer , conditional instructions	**3**	**3**	**3**		**3**								**3**	
CO507.2	**Develop** program using string instructions and DOS interrupts	**3**	**3**	**3**		**3**								**3**	
CO507.3	**Develop** programs to interface processor with external devices using PPI(8255)	**3**	**3**	**3**		**3**								**3**	
C507		**3**	**3**	**3**		**3**								**3**	

Course Title : Database Management System lab.			
Course Code: P15CSL58	**Semester : V**	**L-T-P-H: 0:1.2:3**	**Credits: 1.5**
Contact Period : Practical : 3 Hrs/Week, Exam: 3Hrs		**Weightage :CIE:50% SEE:50%**	

Course Content

1. Consider the following relations:
   Student (*snum:* integer, *sname:* string, *major:* string, *level:* string, *age:* integer)
   Class (*name:* string, *meets at:* time, *room:* string, fi*d:* integer)
   Enrolled (*snum:* integer, *cname:* string)
   Faculty (fi*d*: integer, *fname:* string, *deptid:* integer)
   The meaning of these relations is straightforward; for example, Enrolled has one record per student-class pair such that the student is enrolled in the class. Level is a two character code with 4 different values (example: Junior: JR etc)

Write the following queries in SQL. No duplicates should be printed in any of the answers.

i. Find the names of all Juniors (level = JR) who are enrolled in a class taught by Prof. Harshith
ii. Find the names of all classes that either meet in room R128 or have five or more Students enrolled.
iii. Find the names of all students who are enrolled in two classes that meet at the same time.
iv. Find the names of faculty members who teach in every room in which some class is taught.
v. Find the names of faculty members for whom the combined enrollment of the courses that they teach is less than five.

2. The following relations keep track of airline flight information:

Flights (*no:* integer, *from:* string, *to:* string, *distance:* integer, *Departs:* time, *arrives:* time, *price:*real)
Aircraft (*aid:* integer, *aname:* string, *cruisingrange:* integer)
Certified (*eid:* integer, *aid:* integer)
Employees (*eid:* integer, *ename:* string, *salary:* integer)
Note that the Employees relation describes pilots and other kinds of employees as well; Every pilot is certified for some aircraft, and only pilots are certified to fly.
Write each of the following queries in SQL.

i. Find the names of aircraft such that all pilots certified to operate them have salaries more than Rs.80, 000.
ii. For each pilot who is certified for more than three aircrafts, find the *eid* and the maximum *cruisingrange* of the aircraft for which she or he is certified.
iii. Find the names of pilots whose *salary* is less than the price of the cheapest route from Bengaluru to Frankfurt.
iv. For all aircraft with *cruisingrange* over 1000 Kms, .find the name of the aircraft and the average salary of all pilots certified for this aircraft.
v. Find the names of pilots certified for some Boeing aircraft.
vi. Find the *aid*s of all aircraft that can be used on routes from Bengaluru to New Delhi.

1. Consider the following database of student enrollment in courses & books adopted for each course.

STUDENT (regno: string, name: string, major: string, bdate:date)
COURSE (course #:int, cname:string, dept:string)
ENROLL (regno:string, course#:int, sem:int, marks:int)
BOOK _ ADOPTION (course# :int, sem:int, book-ISBN:int)
TEXT (book-ISBN:int, book-title:string, publisher:string, author:string)

i. Create the above tables by properly specifying the primary keys and the foreign keys.
ii. Enter at least five tuples for each relation.
iii. Demonstrate how you add a new text book to the database and make this book be adopted by some department.
iv. Produce a list of text books (include Course #, Book-ISBN, Book-title) in the alphabetical order for courses offered by the 'CS' department that use more than two books.
v. List any department that has *all* its adopted books published by a specific publisher.
vi. Generate suitable reports.

2. The following tables are maintained by a book dealer.
   AUTHOR (author-id:int, name:string, city:string, country:string)
   PUBLISHER (publisher-id:int, name:string, city:string, country:string)
   CATALOG (book-id:int, title:string, author-id:int, publisher-id:int, category-id:int, year:int, price:int)
   CATEGORY (category-id:int, description:string)
   ORDER-DETAILS (order-no:int, book-id:int, quantity:int)
   i. Create the above tables by properly specifying the primary keys and the foreign keys.
   ii. Enter at least five tuples for each relation.
   iii. Give the details of the authors who have 2 or more books in the catalog and the price of the books is greater than the average price of the books in the catalog and the year of publication is after 2000.
   iv. Find the author of the book which has maximum sales.
   v. Demonstrate how you increase the price of books published by a specific publisher by 10%.
   vi. Generate suitable reports.
3. Consider the following database for a banking enterprise
   BRANCH(branch-name:string, branch-city:string, assets:real)
   ACCOUNT(accno:int, branch-name:string, balance:real)
   DEPOSITOR(customer-name:string, accno:int)
   CUSTOMER(customer-name:string, customer-street:string, customer-city:string)
   LOAN(loan-number:int, branch-name:string, amount:real)
   BORROWER(customer-name:string, loan-number:int)
   i. Create the above tables by properly specifying the primary keys and the foreign keys
   ii. Enter at least five tuples for each relation
   iii. Find all the customers who have at least two accounts at the *Main* branch.
   iv. Find all the customers who have an account at *all* the branches located in a specific city.
   v. Demonstrate how you delete all account tuples at every branch located in a specific city.

Course Outcomes :

1. Design and implement a database schema for a given problem-domain
2. Create and maintain tables using SQL or MYSQL
3. Populate and query a database
4. Prepare reports Course Outcome

CO-PO mapping

Sem: 5th		Course code : P15CSL58					Title : DBMS Lab							
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	Design and implement a database schema for a given problem-domain	3	3		3		3	3		3		1	3	3	
CO2	Create and maintain tables using SQL or MYSQL	3	3	3	2			3	3	3		3	3	3	
CO3	Populate and query a database	3		3	3		1	3		3		3	3	3	
CO4	Prepare reports	3					3		3					3	

Course Title : Aptitude and Reasoning Development - Advanced (ARDA)			
Course Code : P15HU510	Semester : 5	L : T : P : H : 2 : 0 : 0 :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 behaviour.

Course Content

Unit – 1

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 – 2

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 – 3

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 4

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 5

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. 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.

Course Outcomes (CO)

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

1. Apply the approach of seven dimension 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

T L O

After learning all the topics of UNIT – I, the student is able to

1. Explain the importance of reading skills. L1
2. Interpret the importance of vocabulary in solving Reading comprehension questions. L4
3. Identify the main idea and supporting details in the paragraph. L2
4. Identify purpose and tone of the author.L2
5. Interpret the use of transition and idea organization pattern. L4
6. Recognize and evaluate arguments and their common structures. L1
7. Solve RC questions methodologically.L5
8. Classify types of questions asked in the RC passages. L2
9. Apply flow chart or mind map to solve RC questions. L4

After learning all the topics of UNIT – II, the student is able to

1. Analyze the properties of average and apply them in the right scenarios.L5
2. Apply the mean deviation method in certain set of questions. L2
3. Distinguish between the usage of simple average and weighted average.L1
4. Apply weighted average concept and formula to solve the problems of mixtures.L2
5. Compare the weighted average method with the alligation method and understand their strengths and limitations. L4
6. Apply the technique of alligation to solve problems in very less duration of time. L2
7. Understand the concept of homogeneity and other properties of mixtures. L4
8. Apply the basic properties of mixtures while solving the problems under the concept of removal and replacement. L2

9. Extend the application of alligation technique to solve the problems of other topics such as Profit and loss, time speed and distance, ratio and comparison etc. L6

After learning all the topics of UNIT – III, the student is able to

1. Define the meaning of basic terms such as Profit, loss, Profit percentage, Loss percentage. L1
2. Understand the meaning of Discount, Discount percentage, Marked price and mark up percentage and explain them. L4
3. Describe the importance of percentage in this chapter and combine the concepts of percentage to simplify the methodology of solving. L4
4. Apply n/d technique the solve the problems efficiently. L2
5. Apply the percentage fraction table for simplification.L2
6. Extend the application of n/d technique in other areas of aptitude where concept of product constancy is involved. L2
7. Solve the problems involving discount and discount percentage.L5
8. Formulate the mark up concept and apply it for better problem solving. L4
9. Apply the knowledge of Profit and loss,discount,discount percentage in day-to-day life. L2
10. Understand the factors to be considered during partnership and solve the solve the problems under partnership. L4

After learning all the topics of UNIT – IV, the student is able to

1. Interpret the series of numbers in Arithmetic, Geometric and Harmonic Progression. L1
2. Summarize the basic concepts of progressions, i.e., arithmetic mean, nth term of a progression. L6
3. Predict the missing terms of the given progression. L5
4. Compare AM, HM and GM. L4
5. Compute the sum or product of n terms in the given progression. L4
6. Differentiate between increasing and decreasing progression and solve application based problems accordingly. L1
7. Understand the theorems governing progressions. L4
8. Identify the similarity and difference between AP, HP and GP. L1
9. Analyze application problems involving combination of concepts of AP, HP and GP or all the three. L5
10. Create own problems based on creative progressive patterns and it's combinations. L6
11. Solve problems based on average speed using concept of HP and AP. L6

After learning all the topics of UNIT – V, the student is able to

1. Recognize the concept of money and time, their relation and interdependency with respect to banking. L1
2. Outline the meaning of Principal, Time, Rate of Interest and Interest earned, and also their relation with one another. L1
3. Interpret the importance of CI in day to day life. L3
4. Illustrate the concept of Interest earned. L2
5. Distinguish between the types of interests.ie, Simple and Compound Interests.L4
6. Understand the difference between Simple and Compound annual growth.L4
7. Compute problems based on Simple Interests, Compound Interests and combination of both.L4
8. Solve application problems based on depreciation value, population of a city etc. L2
9. Apply various concepts of Percentages, Ratio, Algebra, HCF and LCM to solve application based problems. L2
10. Construct own questions involving multiple concepts ranging different difficult levels. L5
11. Solve MCQs faster by application of shortcut methods of Vedic Mathematics to find squares, cubes and roots. 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
Apply the approach of seven dimension to better reading skills.	L2	-	-	-	-	-	-	-	-	M	-	-	-	-	-
Solve the questions under reading comprehension confidently with higher accuracy than random reading.	L4	-	-	-	-	-	-	M	-	M	-	-	-	-	-
Apply the technique of alligation for effective problem solving.	L2	H	-	-	-	-	-	-	-	-	-	-	-	-	-
Interpret the requirement of different methods of calculating average and apply the right method at right scenario.	L4	M	-	-	-	-	-	-	-	M	-	-	-	-	-
Effectively solve problems of profit and loss and problems related to discount, simple interest and compound interest.	L5	H	-	-	-	-	-	-	-	M	-	-	-	-	-
L- Low, M- Moderate, H-High															

B. Course Assessment 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
Apply the approach of seven dimension 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															

Course Title : Entrepreneurship Management & IPR			
Course Code: P15CS61	**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 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.

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 , Departmentation, organization structure, committees, teams

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 .

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.

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

11 Hours

Text Books:

1. **Management and Entrepreneurship ,** N V R Naidu ,T Krishna Rao 4th reprint.
2. **Law relating to Intellectual Property rights** , B. L. Wadhera, 5th edition, 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: P15CS62	**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. Program and Network Properties: Conditions of Parallelism, Partitioning and Scheduling, Program flow Mechanisms, System Interconnect Architecture.

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) RISC Scalar Processor (exclude Sun Microsystems SPARC Architectures) 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).

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, 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, Crossbar Switch and Multiport Memory, Multistage and Combing Networks, 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.

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, Goals of the Parallelization Process, 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.

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 and Organization 3 rd Edition McGraw Hill1998.
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

Sem: 6th		Course code : P15CS62					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**
CO604.1	**Describe** the evolution of computers	3	1	1										3	
CO604.2	**Characterize** the present modern technology & supporting memory hierarchy	2	2	1										2	
CO604.3	**Analyze** the basic properties of pipelining	2	3	2	1									2	
CO604.4	**Discuss** system architecture of multiprocessor and multicomputer	3	2	2										3	
CO604.5	**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: P15CS63	**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; Compiler-Construction tools; Lexical analysis: The Role of Lexical Analyzer; Input Buffering; Specifications of Tokens; Recognition of Tokens.

10 Hours

Unit – 2

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

11 Hours

Unit – 3

Syntax Analysis : Bottom-up Parsing, LR parsers, Using ambiguous grammars.

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; Symbol tables; dynamic storage allocation techniques.

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; 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 Education, 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

Sem: 6th		Course code : P15CS63					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**
CO603.1	**Design** simple lexical analyzer	3	3	2	2	1								3	2
CO603.2	**Construct** simple top down parser for a given context free grammar	3	3	3	3	1								3	3
CO603.3	**Construct** simple bottom up parser for a given context free grammar	3	3	3	3	1								3	3
CO603.4	**Apply** different syntax directed translation schemes	3	3	2	1									3	2
CO603.5	**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 : Computer Networks (Foundation Course-II)			
Course Code: P15CS64	**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

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, IPv4 addresses, forwarding of IP packets.

Network-layer protocols: Internet protocol (IP), ICMPv4, mobile ip

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, transition from ipv4 to ipv6.

10 hours

Unit – 3

Transport layer: Introduction, transport-layer protocols.
Transport-layer protocols: Introduction, user datagram protocol, transmission control protocol, SCTP.

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, telnet, secure shell (ssh), domain name system (dns).
Network management: Introduction, SNMP, asn.1.

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, other aspects of security.
Internet security: Network-layer security, transport-layer security, application-layer security, firewalls.

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

Sem: 6th		Course code : P15CS64					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**

Elective-II

Course Title : Client Server Programming			
Course Code: P15CS651	**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

Sem: 6th		Course code : P15CS651					Title : Client Server Programming								
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** 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
C		**2**	**2**											**2.6**	**2.8**

Course Title : Soft Computing Technique			
Course Code: P15CS652	**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- single layer and multilayer feed forward networks- McCullochPitts neuron model- perceptron model- Adaline and Madaline- multilayer perception model- back propogation learning methods- effect of learning rule coefficient -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- limitations and applications- Hopfield v/s Boltzman machine- Adaptive Resonance Theory- Architecture- classifications-Implementation and training-Associative Memory

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 knowledge and rule bases-Fuzzy modeling and control schemes for nonlinear systems. Self organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system

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 and 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-Stability analysis of fuzzy control systems.

10 Hours

Text Book:

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

References 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

Sem:6th		Course code : P15CS652					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 programming.		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
C		**2**	**2.8**												**2.8**

Course Title : Pattern Recognition			
Course Code: P15CS653	**Semester : VI**	**L:T:P: H - 4 : 0 : 0 : 4**	**Credits: 3**
Contact Period : Lecture :52 Hr, Exam: 3Hr		**Weightage :CIE:50% SEE:50%**	

Perquisites:

Basic knowledge in engineering mathematics, Linear Algebra, Fundamentals of probability theory and statistics, programming knowledge.

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; 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; 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; 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; Criterion Functions for Clustering.

10 Hours

Unit 5

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

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 Approaches",
   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

Sem: 5th		Course code : P13CS653					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**
CO653.1	**Classify** patterns using Bayesian Decision Theory.		2				2	3	1	2		2		2	
CO653.2	**Classify** patterns using Parametric and Non-Parametric techniques		3	1			2	2	1	2		2		2	
CO653.3	**Perform** Subspace analysis for classification problems and compare with other classification algorithms.		3	2		2	2	3	1	2		2	1	2	
CO653.4	**Choose** between single Gaussian and mixture models for classification based on the applications.				3		2	1		2				2	
CO653.5	**Understand** various biometric technologies and its merits and demerits.		3		2	2	2	2		2		2	2	2	
C653			**2.75**	**1.5**	**2.5**	**2**	**2**	**2.2**	**1**	**2**		**2**	**1.5**	**2**	

Course Title : Software Agents			
Course Code: P15CS654	**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

1. Agent based intelligent systems

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. 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; multi-agent learning

10 Hours

Unit-3

Agent Communication And Collaboration

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

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. Agent societies and societal issues

10 Hours

Unit-5

Mobile Agents

Mobile agent paradigm - Mobile agent concepts -Mobile agent technology – programming mobile agents –application of mobile agents- Teleshopping. Mobile agent security- trust, reliability and reputation.

10 Hours

Text Book:

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

References Books:

1. Lin, Fuhua Oscar (Ed.), "Designing Distributed Learning Environments with IntelligentSoftware 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

Sem: 6th		Course code : P15CS654					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 Communication			
Course Code: P15CS661	**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: Know the concept of networking

Course Learning Objectives (CLOs)

This course aims to

1. **Describes** a comprehensive, Broad-based coverage of the fundamental aspects of the most popular forms of wireless telecommunications systems and emerging wireless technologies used to extend the reach of the wired public or private data network.
2. **Understanding** about the fundamental operations of the wireless technologies used by professionals and technicians involved in a technical-support segment of this field.
3. **Understand and** Gain knowledge about other popular technologies in this and next generation of wireless telecommunications system and networks.
4. **Understand and analyze** of both major cellular technologies (GSM and CDMA) provides the reader with a clearly defined path for the migration from these technologies to 3G cellular.
5. **Understanding** the concepts of GSM and CDMA cellular systems, 3G cellular, and IEEE standards-based wireless LANs, PANs, and MANs.
6. **Describe** emerging wireless air interface and network technologies that will be incorporated into the next generation of wireless systems.

Relevance of the course:

1. This course presents the theoretical knowledge needed and fundamental aspects of the most popular forms of wireless telecommunications systems and emerging wireless technologies used to extend the reach of the wired public or private data network.
2. The student will also understand the concepts of GSM and CDMA cellular systems, 3G cellular, and IEEE standards-based wireless LANs, PANs, and MANs.
3. This course gives students sufficient preparation for the Wireless Technologies course.

Course Content

Unit 1

History and evolution of wireless radio systems, Different generations of wireless cellular networks. Common cellular system components: Common cellular network components, software views of cellular network, 3G cellular system components, Identification, call establishment.

10 Hours

Unit 2

Wireless Network Architecture and operation The cellular concept, cell fundamentals, capacity expansion techniques, cellular backhaul networks, mobility management, wireless network security. GSM and TDMA technology: Introduction to GSM and TDMA, GSM network and system architecture, GSM channel concept, GSM system operations, GSM Identifiers, GSM protocol architecture, TDMA systems.

10 Hours

Unit 3

CDMA technology, CDMA overview, CDMA network and system architecture, CDMA channel concept, CDMA operations, Cellular wireless data networks - 2.5 and 3G systems: CDPD, GPRS and EDGE data networks, CDMA data networks, Evolution of GSM and NA-TDMA to 3G, SMS, EMS, MMS and MIM services.

11 hours

Unit 4

Wireless Modulation Techniques and hardware: Transmission characteristics of Wire line and fiber systems, characteristics of the air interface, wireless telecommunications coding techniques, digital modulation techniques, spread Spectrum modulation techniques, UWRT Technology, diversity techniques.

10 Hours

Unit 5

Broadband satellite and microwave systems: Introduction, Fundamentals of satellite systems, broadband and satellite networks, broadband microwave and millimeter wave system. Emerging wireless technologies: Introduction to emerging wireless network technologies, new emerging air interface technologies, and new wireless network implementations.

11 hours

Text Book:

1.Wireless Telecom systems and networks, Mullet Thomson learning, 2010

Reference Books:

1. Fundamentals of wireless communication, David Tse, Pramod Viswanath, Cambridge 2000.
2. Mobile Cellular Telecommunication. Lee W.C.Y,MGH 2002

Course Outcomes

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

1. **Distinguish** between various generation of cellular system.
2. **Describe** the cellular concept and advantage of frequency reuse and distinguish between GSM and TDMA.
3. **Identify** the CDMA techniques.
4. **Analyze** the different wireless modulation techniques and their advantages.
5. **Differentiate** the various broadband satellite and microwave system.

CO-PO mapping

Sem: 6th		Course code : P15CS661					Title : Wireless Communication								
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**
CO704.1	**Evaluate** emerging and proposed standards for the main components of Web services architectures.	2	1	2			1	1						2	2
CO704.2	**Describe** the cellular concept and advantage of frequency reuse and distinguish between GSM and TDMA.	2	3	2				1						2	2
CO704.3	**Identify** the CDMA techniques.	2	2	2										2	2
CO704.4	**Analyze** the different wireless modulation techniques and their advantages.	2	2	2										2	2
CO704.5	**Differentiate** the various broadband satellite and microwave system.	2	3	3				1						2	2
C704		**2**	**2.2**	**2.2**			**1**	**1**						**2**	**2**

Course Title : Semantic Web Technologies			
Course Code: P15CS662	**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. Understand the concept structure of the Semantic Web technology and how this technology revolutionizes the World Wide Web and its uses.
2. Understand the concepts of metadata, semantics of knowledge and resource, ontology, and their descriptions in XML-based syntax and web ontology language (OWL).
3. Describe logic semantics and inference with OWL.
4. Understand Semantic Web query languages (SPARQL).
5. Use ontology engineering approaches in semantic applications.

Course content

Unit-1

Introduction to Semantic Web: Web, Web 2.0, Syntactic Web, Web 3.0 and Semantic Web; why Semantic Web; Impact of Semantic Web; Myths about Semantic Web; Semantic Modeling. Overview of Web and XML technologies

10 Hours

Unit-2

Resource Description Framework (RDF): Introduction to Knowledge Representation (KR) formalisms; meta-data and KR for the Web; the Layer Cake; Attribute Languages, Description Logic and Inference; RDF statements, triples and graphs; RDF/XML; RDF stores and databases; RDF parsers; inference in RDF.

12 Hours

Unit-3

Ontologies: Introduction to Classification Theory; Vocabulary, Thesauri, Taxonomy and Ontology; types of ontologies; ontology exemplars; introduction to ontological engineering.

8 Hours

Unit-4

RDF Schema and OWL: Defining hierarchies in RDFS; RDFS modelling; RDFS-Plus; Microformats, RDFa, SKOS; FOAF; Basic OWL; Class, Properties and Constraints; Individuals; XSD Datatypes; Class Axioms; ontology development methodology; ontology tools; SPARQL.

12 Hours

Unit – 5

Applications and Trends: Applications of Semantic Web; Software Agents; Semantic Search; Knowledge Management; Semantic Desktop; Semantic Web Services; semantics in Social Networking; Geospatial Semantic Web; Rule Languages, RIF and business systems; RSS, MOM, EAI, SOA, EII, and ETL; the Future of the Net.

10 Hours

Textbooks:

1. **Semantic Web:** Concepts, Technologies and Applications, Karin K. Breitman, Marco Antonio Casanova and Walter Truszkowski, Springer International Edition, 2007.
2. **Semantic Web for the Working Ontologist:** Effective Modeling in RDFS and OWL, Dean Allemang and James Hendler, Morgan Kaufmann Publishers, 2008 (2nd edition 2011). .

References:

1. Semantic Web for Dummies, Jeffrey T. Pollock, John Wiley, 2009.
   Ontological Engineering, Asuncion Gomez-Perez, Mariano Fernandez-Lopez and Oscar
   Corcho, Springer International Edition, 2004.
2. Semantic Web Programming, John Hebeler, Matthew Fisher, Ryan Blace and Andew Perez-Lopez, Wiley India, 2009.
3. Programming the Semantic Web, Toby Segaran, Colin Evans and Jamie Taylor, O'Reilly, 2009.

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** SPARQL queries to retrieve data over heterogeneous sources
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	L	3
CO2	**Describe** RDF and RDFS	3	2	3	1					2		2	2		3
CO3	**Understand and Describe** ontologies	3	3	3		2				2		2			3
CO4	**Apply** SPARQL queries to retrieve data over heterogeneous sources	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: P15CS663	**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.

Relevance of the Course:

This course aims to provide a comprehensive learning on service oriented system, which will enable you to make more informed decisions in an increasingly complex IT environment and builds a strong understanding of underlying patterns of architecture.

Course Content

Unit-1

Roots of SOA – Characteristics of SOA - Comparing SOA to client-server and distributed internet architectures –Anatomy of SOA- How components in an SOA interrelate - Principles of service orientation.

10 Hours

Unit -2

Web services – Service descriptions – Messaging with SOAP –Message exchange Patterns – Coordination –Atomic Transactions – Business activities – Orchestration – Choreography- Service layer abstraction– Application Service Layer – Business Service Layer- Orchestration 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 – Entity-centric business service design – Application service design – Taskcentric 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) – Web Services Interoperability Technologies (WSIT) - SOA support in .NET – Common Language Runtime - ASP.NET web forms - ASP. NET web services – Web Services Enhancements (WSE)

12 Hours

Unit -5

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

9 Hours

Text Books:

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 and Choreography.
5. Discuss about various WS-* specification standards.

CO-PO Mapping

Sem : 6th		Course code : P15CS663					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 : Data Warehousing and Mining			
Course Code: P15CS664	**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 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

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.

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, Major issues in data mining .Data Preprocessing: An overview, Data cleaning, Data integration, Data reduction, Data transformation and data discretization.

12 Hours

UNIT – 3

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

10 Hours

Text Book:

1. Jiawei Han, Micheline Kamber, 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 Micheline Kamber: 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, Mc GrawHill Publisher, 1997.
4. Insight into Data Mining – Theory and Practice – K.P.Soman, Shyam Diwakar, 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

Sem: 6th		Course code : P13CS664					Title : Data Warehousing & Mining								
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**
CO661.1	**Analyze** different data models used in data warehouse.	3	2			1									2
CO661.2	**Apply** different preprocessing techniques for different attributes.	3	2	2		1									2
CO661.3	**Determine** frequent item set using association rules.	3	2	2		1									2
CO661.4	**Apply** different classification techniques to classify the given data set.	3	2	2		1									2
CO661.5	**Analyze** different clustering techniques.	3	2	2		1									2
C661		**3**	**2**	**2**		**1**									**2**

Course Title : Networks lab.			
Course Code: P15CSL67	**Semester : VI**	**L:T:P: H - 0 : 1 : 2 : 3**	**Credits: 3**
Contact Period : Practical : 3 Hrs/Week, Exam: 3 Hrs		**Weightage :CIE:50% SEE:50%**	

Course Content

PART - A

Simulation Exercises :

Simulate the following programs using Cisco Packet tracer

1) Simulate the given topology and observe the working of each devices
   i) LAN 1 have three devices connected to a hub1 .
   ii) LAN 2 have two devices connected to a hub2 .
   iii) Both the hubs are connected to a switch which is intern connected to a server
2) Simulate a topology with 2 LAN s each having two devices connected to switches. Switches are connected to a common router. Observe the packet flow.
3) Simulate the topology where two networks are connected via two routers. Both the routers are in tern connected. Each LAN has only one device. Use static routing and observe the routing table at the end of simulation.

4) Simulate a topology where 3 routers are fully connected and a single device is connected to each router. Observe the flow of ICMP packets from one network to other.
5) Configure a network for browsing.

PART – B

Implement the following in C/C++:

1. Write a program for error detecting code using CRC.
2. Write a program for distance vector algorithm to find suitable path for transmission.
3. Using TCP/IP sockets, write a client – server program to make the client send the file name and to make the server send back the contents of the requested file if present.
4. Implement the above program using as message queues or FIFOs as IPC channels.
5. Write a program for simple RSA algorithm to encrypt and decrypt the data.
6. Write a program for Hamming code generation for error detection and correction.
7. Write a program for congestion control using leaky bucket algorithm

CO-PO mapping

CO	Course outcomes	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO608.1	Analyze the network devices to interface a LAN and simulate	2		1											3
CO608.2	Develop LAN system to communicate with router and servers			3											3
CO608.3	Implement algorithms for identifying errors in communication networks	2		1											3
CO608.4	Implement a client server channel establishment for message passing using TCP/IP			2											2
CO608.5	Develop algorithm to provide solution for congestion due to traffic inside the network channel			2											2
															2.6

Course Title : Operating System & Compiler Design Lab.			
Course Code: P15CSL68	**Semester : VI**	**L:T:P: H - 0 : 1 : 2 : 3**	**Credits: 3**
Contact Period : Practical : 3 Hrs/Week, Exam: 3Hrs		**Weightage :CIE:50% SEE:50%**	

Operating System

1. Given the list of processes, their CPU burst times and priorities, write a program to compute and print the average waiting time and average turnaround time. For Priority scheduling policy.
2. Given the list of processes, their CPU burst times and time slice, write a program to compute and print the average waiting time and average turnaround time for Round robin scheduling policy.
3. Implement Banker's Deadlock Avoidance algorithm for multiple resources.
4. Implement the BEST FIT memory allocation technique.
5. Implement the FIFO page replacement algorithm.
6. Implement the Optimal page replacement algorithm.
7. Implement the C-SCAN Disk scheduling algorithm.

Compiler Design

8. Programs on lexical analyzer (lex and yacc).
9. Programs on regular expressions.
10. Programs on parser.

Course Outcomes

Students will be able to

1. **Implement** and **Compare** the different algorithms for CPU Scheduling.
2. **Implement** algorithms for handling synchronization.
3. **Implement** algorithms for memory management and disk scheduling.
4. **Use** the powerful compiler generation tools such as Lex and YACC.
5. **Implement** parser.

CO-PO mapping

CO	Course outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 608.1	**Implement** algorithms for CPU Scheduling.			3											3
CO 608.2	**Implement** algorithms for handling synchronization.			3											3
CO 608.3	**Implement** algorithms for memory management and disk scheduling.			3											3
CO 608.4	**Implement** lexical analyser .			3											3
CO 608.5	**Implement** parser			2											2
				2.8											2.8

Course Title : Aptitude and Reasoning Development - EXPERT (ARDE)			
Course Code : P15HU610	Semester : VI	L : T : P : H - 2 : 0 : 0 : 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 – I

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

Topic Learning Outcomes

After learning all the topics of UNIT – I, the student is able to

1. Recognize the properties of a function by observing its graphical representation. L3
2. Write the general equations for the functions by analyzing the characteristics.L1
3. Write tabular and graphical representation of the fuctions.L1
4. Differentiate between even and odd functions.L2
5. Compose the inverse of a functions.L2
6. Analyze the shifting of graphs and combining movements.L5
7. Modify the equations under some constraints to get the required graph.L3
8. Design the logical graphical process for solving the inequalities.L4
9. Analyze the graphical view of logarithmic functions.L5
10. Compute the roots of linear, quadratic and cubic equations.L6
11. Describe the properties of quadratic equations and their roots.L1
12. Analyze the sign of quadratic expressions and infer the results graphically.L5

After learning all the topics of UNIT – II, the student is able to

1. Apply the fundamental principle of counting to solve basic level problems and apply its logic in complex problems.L2
2. Distinguish between permutation and combination.L4
3. Combine the principles of counting with combination to solve the problems on permutation.L4
4. Select and arrange "r" objects out of "n" objects under different constraints.L4
5. Criticize the restricted use of ${}^{n}P_{r}$.L6
6. Analyze the concept of step arrangement and apply its principles in problem solving.L5
7. Analyze the permutation of things when some of them are identical.L5
8. Apply the concepts of combination.L2
9. Describe the applications of the concept of 2^{n}.L1
10. Solve the problems under division of things into groups.L3
11. Differentiate between linear arrangement and circular arrangement.L3
12. Recognize the importance of probability. L4
13. Use the conjunction AND tool and OR tool.L2
14. Define an event and solve it under specific constraints.L1
15. Develop the ability to apply the concepts of probability and its applications in real file scenarios.L6

After learning all the topics of UNIT – III, the student is able to

1. Interpret the format of any given problem. L4
2. Interpret whether a given statement qualify as a punchline. L4
3. Analyze an idea or a wavelength. L5
4. Develop a methodology to solve a punchline problem. L3
5. Evaluate problems involving strengthening and weakness problem. L6
6. Device a universal strategy to solve the problems of logical reasoning. L3
7. Interpret cause and effect problems and solve them logically. L2
8. Differentiate between immediate cause and a principal cause and apply the knowledge of it in problem solving. L1

After learning all the topics of UNIT – IV, the student is able to

1. Distinguish between data sufficiency type problems and any other problem. L1
2. Apply the universal strategies taught in solving problems. L5
3. Apply the strategy to solve problems under the topics such as Number system, Algebra, series and sequence. L5
4. Apply the strategy to solve problems under the topics such as logical, geometry and mensuration, arithmetic. L5
5. Apply the knowledge of flow chart and mind map to tackle problems. L4

After learning all the topics of UNIT – V, the student is able to Demonstrate better interpretation and representation of data.L1

1. Discover various forms of data representation their advantages and disadvantages.L1
2. Analyze the data provided in the form of tabular column, pie graph, bar graph, line graph, combination of two or more. L5
3. Understand the concept of angles and area swept in a pie chart. L5
4. Apply simple arithematics and shortcuts to solve problems based on given graph. L2
5. Identify percentage hacks and use shortcuts to find the actual value when percentage is given.L4
6. Convert ratios to percentages and vice versa. L4
7. Analyze case studies based on statistical data. L5
8. Identify the limitations of each data representation technique. L6
9. Choose better, the correct method to represent statistics in corporate presentations. L2

L- Low, M- Moderate, H-High															
A. Course Assessment 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	M	-	-	-	M	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	M	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	H	-	-	-	M	-	-	-	M	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	H	-	-	-	-	-	-	-	M	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	M	-	-	-	-	-	-	-	-	-	-	-	-	-
1 – Low, 2 – Moderate and 3 – High															

B. 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	M	-	-	-	M	-	-	-	-	-	-	-	-	-
Infer the conclusions based on the roots obtained by solving quadratic equations and establish relationship between them.	L6	M	-	-	-	-	-	-	-	-	-	-	-	-	-
Effective solve the problems of permutation and combination.	L4	H	-	-	-	M	-	-	-	M	-	-	-	-	-
Predict different possibilities by the principle of probability.	L3	H	-	-	-	-	-	-	-	M	-	-	-	-	-
Interpret the data given in the graphical format and infer the results.	L5	M	-	-	-	-	-	-	-	-	-	-	-	-	-
L- Low, M- Moderate, H-High															