NOORUL ISLAM CENTRE FOR HIGHER EDUCATION

(Deemed to be University Under Section 3 of the UGC Act, 1956)
Kumaracoil, Thuckalay

DEPARTMENT OF COMPUTER APPLICATIONS

MASTER OF COMPUTER APPLICATIONS

CURRICULUM AND SYLLABI

REGULATION 2020

NOORUL ISLAM CENTRE FOR HIGHER EDUCATION, Kumaracoil

Regulation : 2020

Curriculum and Syllabi

MCA Programme

DEPARTMENT OF COMPUTER APPLICATIONS

MCA - MASTER OF COMPUTER APPLICATIONS

Vision of the University

To be recognized by the Government and society at large as an institution able to deliver excellence with relevance in the field of higher education and research focusing on the needs of the nation in tune with the technological revolution to cope with the knowledge explosion and global competence.

Mission of the University

To develop the institution as a Centre of Excellence, keeping pace with the advances in the field, so as to provide quality higher education to the students and in still in them high standards of discipline and ethics so that they become enlightened individuals in the service of humanity and to carry out focused research in the frontier areas of science and technology.

FACULTY OF INFORMATION AND COMPUTER ENGINEERING

DEPARTMENT OF COMPUTER APPLICATIONS

Vision

The department of Computer Applications aims to prepare the students technically competent, **be industry-ready and achieve academic excellence by continuous learning**to meet the current challenges of computing industry.

Mission

- To provide quality education to meet the global needs and challenges of profession and society.
- To provide necessitate based quality training in the field of computer applications.
- To provide technical solution to the real time application requirement for the local society.
- To provide theoretical and practical knowledge across recent developments in computer science in software development.

Description of the programmme

MCA stands for Master of Computer Applications, and it is a postgraduate degree course in the field of computer applications. The course is designed to provide students with a comprehensive understanding of computer programming languages, software development, database management, and other related subjects. he MCA course is highly regarded in the IT industry and provides students with a wide range of career opportunities. Graduates of the MCA course can work in various roles, such as software developers, web designers, system analysts, database administrators, and more.

PROGRAMME EDUCATIONAL OBJECTIVES - PEO	
PEO-01	Graduates will demonstrate strong technical skills in software development, data management, and system design, enabling them to solve complex problems in various domains.
PEO-02	Graduates will apply analytical and critical thinking skills to analyze real-world problems and develop innovative solutions using modern technologies.
PEO-03	Graduates will engage in continuous professional development, adapting to evolving technologies and methodologies in the field of computer applications.
PEO-04	Graduates will effectively collaborate in diverse teams and take on leadership roles, contributing to project success and fostering a positive work environment.
PEO-05	Graduates will understand the ethical implications of technology and will demonstrate a commitment to social responsibility in their professional practice.
PEO-06	Graduates will be equipped with the skills to identify opportunities, innovate, and potentially start their own ventures in the field of information technology.

Graduate Attributes-GA	
GA-01	**Advanced Computing Knowledge** Master core and advanced concepts in computer applications, including algorithms, software development, database management, and networking, to build robust and scalable systems for diverse industries.
GA-02	**Software Design and Development** Exhibit proficiency in designing and developing efficient, user-friendly software applications using modern programming languages, frameworks, and tools, meeting the specific needs of businesses and organizations.
GA-03	**Data Analytics and Machine Learning** Utilize data analytics, machine learning algorithms, and artificial intelligence to interpret complex data sets, derive meaningful insights, and implement intelligent, data-driven solutions.
GA-04	**Mobile and Web Application Development** Develop expertise in mobile and web application development, using state-of-the-art technologies and methodologies to create responsive, secure, and high-performing applications for a global audience.
GA-05	**Cybersecurity and Information Assurance** Demonstrate knowledge of cybersecurity principles and practices, implementing security measures to protect data, software, and networks from potential threats and vulnerabilities.

GA-06	**Cloud Computing and Distributed Systems** Gain proficiency in cloud computing, virtualization, and distributed systems, leveraging these technologies to build flexible, scalable, and cost-effective IT solutions.
GA-07	**Ethics and Professional Responsibility in Computing** Uphold ethical principles and professional responsibility in software development and data handling, ensuring that technological solutions prioritize security, privacy, and fairness.
GA-08	**Entrepreneurship and Innovation in Technology** Foster an entrepreneurial mindset, identifying opportunities for innovation in computer applications and translating them into technology-driven products and services that address real-world challenges.
GA-09	**Collaborative Teamwork and Leadership** Work effectively in teams, collaborating on software projects, and demonstrating leadership skills to manage multidisciplinary teams and deliver successful IT solutions in complex environments.
GA-10	**Lifelong Learning and Technological Adaptability** Embrace continuous learning and adaptability, staying up-to-date with the latest technologies, programming languages, and industry trends to remain competitive and innovative in the dynamic IT field.

Programme Outcome – PO	
PO-A	Apply the knowledge of mathematics and computing fundamentals to various real life applications for any given requirement.
PO-B	Analyze and review literatures to invoke the research skills to design, interpret and make inferences from the resulting data.
PO-C	Design applications for any desired needs with appropriate considerations for any specific need on societal and environmental aspects
PO-D	Design and develop applications to analyze and solve all computer science related problems.
PO-E	Involve in perennial learning for a continued career development and progress as a computer professional.
PO-F	Integrate and apply efficiently the contemporary IT tools to all computer applications.
PO-G	Function effectively both as a team leader and team member on multi-disciplinary projects to demonstrate computing and management skills.
PO-H	Solve and work with a professional context pertaining to ethics, social, cultural and cyber regulations.

PO-I	Utilize the computing knowledge efficiently in projects with concern for societal, environmental, and cultural aspects.
PO-J	Create and design innovative methodologies to solve complex problems for the betterment of the society.
PO-K	Function competently as an individual and as a leader in multidisciplinary projects
PO-L	Communicate effectively and present technical information in oral and written reports
PO-M	Apply the inherent skills with absolute focus to function as an successful entrepreneur

Mapping of Graduate Attributes (GAs) and Programme Educational Objectives(PEOs)

GAs / **PEOs**	**GA-01**	**GA-02**	**GA-03**	**GA-04**	**GA-05**	**GA-06**	**GA-07**	**GA-08**	**GA-09**	**GA-10**
PEO-01	H	A	H	A	H	H	H	A	H	H
PEO-02	H	H	A	H	A	H	H	A	H	A
PEO-03	H	A	H	H	A	H	H	A	H	H
PE0-04	H	H	A	H	A	A	H	H	A	A
PEO-05	A	H	H	A	A	H	A	H	A	A
PEO-06	H	A	H	H	A	H	H	A	H	H

H- Highly Associated A- Associated Not – Not Associated

Mapping of Graduate Attributes (GAs) and Programme Outcomes (PO)

GAs / POs	GA-01	GA-02	GA-03	GA-04	GA-05	GA-06	GA-07	GA-08	GA-09	GA-10
PO-A	H	A	H	A	H	A	H	H	A	A
PO-B	H	H	A	H	A	H	A	H	H	A
PO-C	A	H	A	H	A	H	A	A	H	A
PO-D	H	H	A	H	A	A	A	H	H	A
PO-E	A	H	H	A	A	H	A	H	A	A
PO-F	A	H	A	A	H	A	A	H	H	A
PO-G	A	H	A	A	A	H	A	A	A	A
PO-H	A	H	A	A	A	H	A	H	H	H
PO-I	A	H	A	H	H	H	A	A	H	A
PO-J	A	H	A	H	A	H	A	A	H	A
PO-K	A	H	A	A	A	H	A	H	H	H
PO-L	A	H	A	H	H	H	A	A	H	A
PO-M	A	H	A	H	A	H	A	A	H	A

H- Highly Associated A- Associated Not – Not Associated

Mapping of Programme Educational Objective (PEOs) and Programme Outcomes (POs)

PEO / PO	PEO-01	PEO-02	PEO-03	PEO-04	PEO-05	PEO-06
PO-A	H	A	H	A	H	A
PO-B	A	H	A	H	H	H
PO-C	H	H	H	A	H	A
PO-D	H	A	A	A	H	A
PO-E	A	A	A	H	A	H
PO-F	H	A	H	A	H	H
PO-G	H	H	H	H	H	A
PO-H	H	A	A	H	H	A
PO-I	A	H	H	A	A	H
PO-J	H	A	A	H	A	H
PO-K	H	H	H	H	H	A
PO-L	H	A	A	H	H	A
PO-M	A	H	H	A	A	H

H- Highly Associated A- Associated Not – Not Associated

Duration of the Programme : 2 years (4 semesters)

Total : 88

CURRICULUM & SYLLABI

SEMESTER – I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3501	Digital Logic and Computer Organization	3	0	0	3
2.	CA3502	Operating System and System Software	3	0	0	3
3.	CA3503	Database Management System	3	0	0	3
4.	CA3504	Data Structures Using C Programming	3	1	0	4
5.	MA3505	Operations Research	3	1	0	4
PRACTICAL						
6.	CA3571	Database Management Systems Laboratory	0	0	2	2
7.	CA3572	Data Structures Using C Laboratory	0	0	2	2
TOTAL			15	4	4	**21**

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3505	Data Communication and Networks Programming	3	1	0	4
2.	CA3506	Object Oriented Programming Using Java	3	1	0	4
3.	CA3507	Problem Solving Using Python	3	0	0	3
4.	CA3508	Software Engineering	3	0	0	3
5.	E-I	Elective -1	3	0	0	3
6.	E-II	Elective –2	3	0	0	3
PRACTICAL						
7.	CA3573	Python Programming Laboratory	0	0	2	2
8.	CA3574	Java Programming and Networks Laboratory	0	0	2	2
TOTAL			18	4	4	**24**

SEMESTER - III

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3509	Data Science and Cloud Computing	3	1	0	4
2.	CA3510	Visual Programming	3	1	0	4
3.	E-III	Elective –3	3	0	0	3
4.	E-IV	Elective – 4	3	0	0	3
5.	E-V	Elective –5 (Open Elective)	3	0	0	3
PRACTICAL						
6.	CA3575	Visual Programming Laboratory	0	0	2	2
7.	CA35P1	Project Work – Phase I	0	0	12	6
TOTAL			15	3	14	**25**

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CA35P2	Project Work – Phase II	0	0	36	18
TOTAL			0	0	36	18

LIST OF ELECTIVES

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
ODD SEMESTER ELECTIVES						
1.	CA35A1	Software Reuse	3	0	0	3
2.	CA35A2	Software Reliability and Metrics	3	0	0	3
3.	CA35A3	Human Resource Management	3	0	0	3
4.	CA35A4	Advanced Soft Computing	3	0	0	3
5.	CA35A5	Knowledge Engineering	3	0	0	3
6.	CA35A6	Digital Image Processing	3	0	0	3
7.	CA35A7	Software Testing	3	0	0	3
8.	CA35A8	User Interface Design	3	0	0	3
9.	CA35A9	Service Oriented Architecture	3	0	0	3

10.	CA35B1	Information Storage Management	3	0	0	3
11.	CA35B2	System Software Internals	3	0	0	3
12.	CA35B3	Bio Informatics	3	0	0	3
13.	CA35B4	Management Information System	3	0	0	3
14.	CA35B5	Software Risk Management and Maintenance	3	0	0	3
15.	CA35B6	Wireless Networks	3	0	0	3
16.	CA35B7	Virtualization Techniques	3	0	0	3
17.	CA35B8	Big Data Analytics	3	0	0	3
EVEN SEMESTER ELECTIVES						
18.	CA35B9	Ad-Hoc Networks	3	0	0	3
19.	CA35C1	Machine Learning Techniques	3	0	0	3
20.	CA35C2	Multimedia Databases	3	0	0	3
21.	CA35C3	Artificial Intelligence Techniques	3	0	0	3
22.	CA35C4	Software Requirements Management	3	0	0	3
23.	CA35C5	Cyber Forensics	3	0	0	3
24.	CA35C6	Mobile Communication Techniques	3	0	0	3
25.	CA35C7	Principles of Compiler Design	3	0	0	3
26.	CA35C8	Information System Security	3	0	0	3
27.	CA35C9	Internet of Things	3	0	0	3
28.	CA35D1	Cryptography And Network Security	3	0	0	3
29.	CA35D2	Software Project Management	3	0	0	3
30.	CA35D3	Data Mining and Data Warehousing	3	0	0	3

SEMESTER – I

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3501	Digital Logic and Computer Organization	3	0	0	3
2.	CA3502	Operating System and System Software	3	0	0	3
3.	CA3503	Database Management System	3	0	0	3
4.	CA3504	Data Structures Using C Programming	3	1	0	4
5.	MA3505	Operations Research	3	1	0	4
PRACTICAL						
6.	CA3571	Database Management Systems Laboratory	0	0	2	2
7.	CA3572	Data Structures Using C Laboratory	0	0	2	2
TOTAL			15	4	4	**21**

CA3501	DIGITAL LOGIC AND COMPUTER ORGANIZATION	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the fundamentals of Boolean logic and functions.
- To design and realize digital systems with basic gates and other components using combinational and sequential circuits.
- To study the instruction sets and operations of a processor.
- To study the different ways of communication with I/O devices and standard I/O Interfaces.
- To study the hierarchical memory system including cache memories and virtual memory.

Course Outcome		Cognitive Skill
CO-01	To study the number system and digital basics	R,U
CO-02	To study about the combinational and sequential circuits	R,U,An
CO-03	To study about fundamentals of computer	R,U,A
CO-04	To study about the functionalities of processor	A,An,E
CO-05	To study about the memory and I/O	A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	L	S	M	L	M	S	S	M	L	S	M	L	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M
CO-04	M	M	S	M	M	S	S	M	M	S	L	L	S
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: DIGITAL FUNDAMENTALS 9

Digital Systems – Binary Numbers – Octal – Hexadecimal Conversions – Signed Binary Numbers – Complements – Logic Gates – Boolean Algebra – K-Maps – Standard Forms – NAND – NOR Implementation.

UNIT II: COMBINATIONAL AND SEQUENTIAL CIRCUITS **9**

Combinational circuits – Adder – Subtractor – ALU Design – Decoder – Encoder – Multiplexers – Introduction to Sequential Circuits – Flip-Flops – Registers – Counters.

UNIT III: COMPUTER FUNDAMENTALS **9**

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language (C language).

UNIT IV: PROCESSOR **9**

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Micro programmed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V: MEMORY AND I/O **9**

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel And Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA.

TOTAL: 45 HOURS

REFERENCES:

1. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Fifth Edition, Morgan Kaufmann/Elsevier, 2013.
2. M. Morris Mano, Michael D. Ciletti, “Digital Design”, Fifth Edition, Pearson Education, 2013.
3. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “ComputerOrganization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
4. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
5. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2008.

CA3502	OPERATING SYSTEM AND SYSTEM SOFTWARE	L	T	P	C
		3	0	0	3

OBJECTIVES

- To have an overview of different types of operating systems and process management
- To know the functions of process synchronization.
- To have a thorough knowledge of memory management
- To have a thorough knowledge of system software, compiler and assembler
- To have a thorough knowledge of loaders and linkers

Course Outcome		Cognitive Skill
CO-01	To study the introduction of operating system and process management	R,U
CO-02	To study the basic concepts of Process synchronization	U,A
CO-03	To study the functionalities of Memory management	S, An
CO-04	To study the Basics of system software, compiler and assembler	An, E
CO-05	To learn about the functions of Loaders and linkers	S,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	M	M	L	L	L	L	M	M	L	L	L	L
CO-02	M	S	L	S	M	S	S	M	M	S	M	M	L
CO-03	S	S	M	M	L	L	M	S	L	S	M	S	S
CO-04	L	L	M	L	S	M	S	S	M	M	L	L	L
CO-05	L	L	M	M	L	S	S	M	S	M	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTRODUCTION & PROCESS MANAGEMENT 9

Definition of OS- Types of systems (Mainframe, Desktop, Multi processor, Distributedand Real time Systems) – Structure of OS. Concepts of process-Process Scheduling-Operations on Processes-Co-operating Processes-Inter Process Communication-CPU Scheduling-SchedulingConcepts-Criteria-Scheduling Algorithms-Multiprocessor Scheduling-Real time Scheduling

UNIT II: PROCESS SYNCHRONIZATION 9

Critical Section-Synchronization Hardware-Semaphores-Problems of Synchronization-Critical Regions-Monitors-Deadlocks-Characterization-Handling Deadlocks-Deadlock Prevention-Avoidance-Detection-Deadlock Recovery

UNIT III: MEMORY MANAGEMENT **9**

Storage Hierarchy-Storage Management Strategies-Contiguous-Non Contiguous Storage Allocation-Single User-Fixed Partition-Variable Partition-Swapping-Virtual Memory-Basic Concepts-Multilevel Organization-Block Mapping-Paging-Segmentation-Page Replacement Methods-Locality-Working Sets

UNIT IV: BASICS OF SYSTEM SOFTWARE, COMPILER AND ASSEMBLER **9**

Introduction – System software and SIC/XE machine architecture - Phases of compiler - Basic assembler functions – Assembler algorithms and data structures – Machine dependent assembler features, Instruction formats and addressing modes – Program relocation – Machine independent assembler features – Literals – Symbol-defining statements – Expressions – Program Blocks – Control Sections and Program Linking.

UNIT V: LOADERS AND LINKERS **9**

Basic loader functions: Design of an Absolute Loader – A Simple Bootstrap Loader Machine dependent loader features Relocation – Program Linking – Algorithm and Data Structures for Linking Loader. Machine-independent loader features – Automatic Library Search – Loader Options Loader design options – Linkage Editors – Dynamic Linking – Bootstrap Loaders. Implementation examples: MSDOS linker.

TOTAL: 45 HOURS

REFERENCES:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw Hill Company, Second Edition, 2009.
2. Leland Beck - “System Software – An Introduction to Systems Programming”, Third Edition, Pearson Education, Inc., 2008
3. Operating System Concepts (8th Edition) by Silberschatz, Peter B. Galvin and Greg Gagne, WileyIndian Edition (2010).
4. Principles of Operating Systems by Naresh chauhan, Oxford Press (2014).

		L	T	P	C
CA3503	**DATABASE MANAGEMENT SYSTEMS**	**3**	**0**	**0**	**3**

OBJECTIVES

- To learn the fundamentals of data models, conceptualize and depict a database system using ER diagram.
- To study the principles to be followed to create an effective relational database and write SQL queries to store/retrieve data to/from database systems.
- To know the fundamental concepts of transaction processing, concurrency control techniques and recovery procedure.
- To learn about the internal storage structures using different file and indexing techniques and the basics of query processing and optimization.
- To study the basics of distributed databases, semi-structured and un-structured data models.

Course Outcome		Cognitive Skill
CO-01	To learn the fundamentals of relational databases	R,U
CO-02	To conceptualize and depict a database system using ER diagram.	R,U,An
CO-03	To know the fundamental concepts of transaction processing- concurrency control techniques and recovery procedure.	A,An,E,S
CO-04	To understand the internal storage structures using different file and indexing techniques which will help in physical DB design.	A,An,E
CO-05	To study and understand the advanced concepts of databases	A,An,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	L	S	M	L	M	S	S	M	L	S	M	L	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M
CO-04	M	M	S	M	M	S	S	M	M	S	L	L	S
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: RELATIONAL DATABASES **9**

Purpose of Database System – Views of Data – Data Models – Database System Architecture – Introduction to Relational Databases – Relational Model – Keys – Relational Algebra – Relational Calculus – SQL Fundamentals – Advanced SQL features – Triggers – Embedded SQL.

UNIT II : DATABASE DESIGN **9**

Entity-Relationship Model – ER Diagrams – Functional Dependencies – Non-Loss Decomposition Functional Dependencies – First Normal Form – Second Normal Form – Third Normal Form – Dependency Preservation – Boyce/Codd Normal Form – Multi-Valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form.

UNIT III: TRANSACTION MANAGEMENT **9**

Transaction Concepts – ACID Properties – Serializability – Transaction Isolation Levels – Concurrency Control – Need for Concurrency – Lock-Based Protocols – Deadlock Handling – Recovery System – Failure Classification – Recovery Algorithm.

UNIT IV: IMPLEMENTATION TECHNIQUES **9**

Overview of Physical Storage Media – RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Catalog Information for Cost Estimation –Query Optimization.

UNIT V: ADVANCED TOPICS **9**

Overview of Distributed Databases – Data Fragmentation – Replication – XML Databases –XML Schema – NOSQL Database: Characteristics – CAP theorem – Types of NoSQL Data stores: Column Oriented, Document, Key-Value and Graph Types – Applications – Current Trends.

TOTAL: 45 HOURS

REFERENCES:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Sixth Edition, Tata McGraw Hill, 2014.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2017.
3. C. J. Date, A. Kannan, S. Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
4. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Fourth Edition, Tata McGraw Hill, 2010.
5. G. K. Gupta, "Database Management Systems", Tata McGraw Hill, 2011.
6. Carlos Coronel, Steven Morris, Peter Rob, "Database Systems: Design, Implementationand Management", Ninth Edition, Cengage Learning, 2011.

		L	T	P	C
CA3504	**DATA STRUCTURES USING C PROGRAMMING**	**3**	**1**	**0**	**4**

OBJECTIVES

- To demonstrate basic and advanced concepts of C programming language.
- To use abstract data types including stacks, queues and lists for any application.
- To design and implement tree data structures.
- To analyze and implement hashing techniques that solve in linear time.
- To apply sorting algorithms for a given problem.
- To choose appropriate data structure and implement a given application.

Course Outcome		Cognitive Skill
CO-01	To understand, analyze, interpret and review basic concepts of C programming language.	An, U
CO-02	To analyze, interpret and review the advanced concepts of C programming language.	A, S
CO-03	To implement abstract data types including stacks, queues and lists for any application.	A,E.
CO-04	To get expertise in designing and implementing tree data structures.	R,S

CO-05	To analyze, review and implement hashing techniques and sorting algorithms.	U, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	M	S	M	M	S	S	M	L	M	S	M	M	M
CO-02	M	S	M	M	M	S	M	M	M	S	M	M	S
CO-03	S	S	M	M	S	S	M	M	M	S	L	S	M
CO-04	M	M	S	S	S	L	M	M	M	S	M	M	M
CO-05	S	M	M	M	S	L	M	L	M	S	M	M	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: BASICS OF C PROGRAMMING 9

Overview of C – Structure of C Programs – Character sets, Constants, Variables and Data types – Operators and Expressions - Formatted I/O Operations - Conditional Statements – Control Statements – Arrays - Character Arrays and Strings.

UNIT II: ADVANCED C PROGRAMMING 9

Functions –Types of Functions- Recursion –Structures –Array of Structures – Array within Structures– Union – Pointers –File Management in C –Command line arguments- Dynamic Memory Allocation – Preprocessor – Macro Substitution – File Inclusion – Compiler Control Directives.

UNIT III: LINEAR DATASTRUCTURES 9

Abstract Data Types (ADTs) – List ADT – Array-Based Implementation – Linked List implementation – Doubly-Linked Lists – Circular Linked Lists – Stack ADT: Implementation of Stacks – Queue ADT: Implementation of Queues – Applications.

UNIT IV: HIERARCHICAL DATA STRUCTURES 9

Trees: Preliminaries – Implementation of Trees – Tree Traversals with an Application – Binary Trees: Implementation – Expression Trees – Search Tree ADT – Binary Search Trees – Applications of Trees.

UNIT V: HASHING AND SORTING 9

Fundamentals of Hashing – Hash Function – Separate Chaining – Open Addressing – Linear Probing – Quadratic Probing – Double Hashing – Rehashing – Extendible Hashing – Sorting Algorithms: Insertion Sort, Shell Sort, Quick Sort, Heap Sort, Merge Sort.

L: 45 + T: 15, TOTAL: 60 HOURS

REFERENCES

1. Brian W. Kernighan, Dennis Ritchie, “The C Programming Language”, Second Edition,

Pearson Education, 2015.
2. TanaenbaumA.S.,Langram Y. Augestein M.J " Data Structures using C" Pearson Education , 2004.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
4. Y. Langsam, M. J. Augenstein, A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2004.
5. Robert Kruse & Bruce Leung, "Data Structures & Program Design in C", Pearson Education, 2007.

MA3505	OPERATIONS RESEARCH	L	T	P	C
		3	1	0	4

OBJECTIVES

To develop mathematical skill to analyze various complex problems and to study the applications of operations research in functional areas of computing like network scheduling, queueing and simulation.

Course Outcome		Cognitive Skill
CO-01	To formulate lpp, solve lpp using graphical method, simplex method, artificial variable technique, two phase method, to solve transportation and assignment problem.	U, R, A, E
CO-02	To understand Bellman principles, characteristics of dynamic programming and solving by recursive method and application problems like allocation problems, cargo loading problems and shortest route problems.	U, R, A, E
CO-03	Solving queuing problems in single and multi server models by applying Littles formula.	U, R, A, E
CO-04	To solve network problems using critical path method and project evaluation and review techniques, solving shortest route problems,.	U, R, A, E
CO-05	Able to simulate real life problems using Monte Carlo simulation, generating random number using congruent techniques and apply simulation to solve queuing problems.	U, R, A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	L	M	M	L	L	M	M	M	M	L	M	M
CO-02	S	L	M	M	L	L	M	M	M	M	L	M	M
CO-03	S	L	M	M	L	L	M	M	M	M	L	M	M

CO-04	S	L	M	M	L	L	M	M	M	M	L	M	M
CO-05	S	L	M	M	L	L	M	M	M	M	L	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: LINEAR PROGRAMMING **9**

Formulation – Graphical solution – Simplex method –Artificial variable technique - Two Phase method - Transportation and Assignment problems.

UNIT II: DYNAMIC PROGRAMMING **9**

Bellman‟s principle of optimality – Characteristics of the dynamic programming model – The recursive equation - Backward and Forward approach – Applications of Dynamic programming problem in Allocation problems, Shortest route problem and Cargo loading Problem

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UNIT III: QUEUEING MODELS **9**

Birth and Death Process - Poisson Process – Markovian Queues – SingleServer Models – Little‟s formula - Queues in Series – Open Queueing Networks –Closed Queueing networks.

UNIT IV: NETWORK MODEL **9**

Shortest Route, Minimal Spanning tree and Maximal flow models – CriticalPath Method – Project Evaluation and Review Technique

UNIT V: SIMULATION **9**

Discrete Event Simulation – Stochastic Simulation - Monte Carlo Simulation– Generation of Random Numbers using Congruent method – Applications to Queueing systems.

L: 45 + T: 15, TOTAL: 60 HOURS

REFERENCES:

1. Taha, H.A. “Operations Research: An Introduction”, Ninth Edition,Pearson Education Edition, Asia, New Delhi, 2002.
2. Robertazzi. T.G. “Computer Networks and Systems – Queuing Theoryand Performance Evaluation”, Third Edition, Springer, 2002 Reprint.
3. S.S. Rao “Optimization Techniques “Prentice Hall of India , 2004.
4. J.K Sharma “Operations Research” Macmillan, 2003

CA3571	DATABASE MANAGEMENT SYSTEMS LABORATORY	L	T	P	C
		0	0	2	2

OBJECTIVES

- To know how to insert and retrieve data from the database.
- To know how to use PL/SQL programs
- To know the advance concepts of DBMS.

Course Outcome		Cognitive Skill
CO-01	Ability to use Data Definition Language commands in SQL.	A
CO-02	Ability to apply Data Manipulation Language commands in SQL.	A
CO-03	Ability to use various string and mathematical functions in SQL.	A
CO-04	Ability to develop PL/SQL programs for various problems.	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	L	S	S	M	M	L	L	L	M	M	L	M
CO-02	M	L	S	S	M	M	L	L	L	M	M	L	M
CO-03	M	L	S	S	M	M	L	L	L	M	M	L	M
CO-04	M	L	S	S	M	M	L	L	L	M	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. SQL Commands using different data types in SQL & DDL and DML Commands.
2. SQL commands using Data Manipulation Language and transaction control Commands.
3. Create set of tables, add data constraints, foreign key constraints and incorporate referential integrity.
4. Query the database tables and explore natural join, equi-join and outer joins.
5. SQL commands using group-by clause and date arithmetic.
6. SQL commands using aggregate, math and stringfunctions.
7. SQL commands using different types of sub queries.
8. SQL commands for creating views, inserting, updating and deleting data in views
9. PL/SQL with Control Structures and Procedures.

10. PL/SQL using Functions, triggers and cursors
11. Create an XML database and validate it using XML schema.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features.

TOTAL: 45 HOURS

REFERENCES:

1. Abraham Silberschatz, HentryF.Korth and S.Sudharssan,"Database System Concepts", 4th Edition, Tata McGraw Hill, 2002
2. Raghu Ramakrishnan &Johannesgerhrke, "Data Base Management Systems", Mc Graw Hill International Edition, 2000

CA3572	DATA STRUCTURES USING C LABORATORY	L	T	P	C
		0	0	2	2

OBJECTIVES

- To introduce the concepts of structured programming language.
- To develop skills in design and implementation of data structures and their applications.
- To learn and implement linear data structures and nonlinear data structures.
- To study and implement hashing techniques.
- To study and analyze the different sorting and searching techniques.

Course Outcome		Cognitive Skill
CO-01	To understand the operations on singly linked list and stack using array.	U, E
CO-02	To remember and implement the basic operations of queue and stack using linked list idea.	R, A
CO-03	To Analyze and Implement the basic operations on Doubly linked list and Circular Linked List.	An, E
CO-04	To Apply Binary Search Tree Traversal and Sort the given list using Insertion Sort.	A, S
CO-05	To Understand and implement the idea of Sort the given list using Quick sort and Merge Sort	U, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

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Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	M	S	M	M	S	S	M	S	M	S	M	M	M

CO-02	M	S	M	M	M	S	M	S	M	S	M	M	S
CO-03	S	S	M	M	S	S	M	M	M	S	L	S	M
CO-04	M	M	S	S	S	M	M	M	M	S	M	M	M
CO-05	S	M	M	M	S	L	M	M	M	S	M	M	L

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS

1. Implementation of simple programs in C using Data types, Variables, Conditional and Iterative Statements.
2. Implementation of simple programs in C using arrays and functions.
3. Implementation of simple programs in C using structures and unions.
4. Implementation of simple programs in C using pointers.
5. Implementation of singly linked list ADT, doubly linked list ADT.
6. Implementation of circular linked list ADT and applications of lists.
7. Implementation of stack ADT using arrays and linked lists and applications of stack.
8. Implementation of queue ADT using arrays and linked lists.
9. Implementation of binary search tree ADT.
10. Implementation of hashing techniques such as separate chaining, open addressing.
11. Implementation of sorting algorithms – insertion sort, shell sort, merge sort.
12. Implementation of searching algorithms – linear search and binary search.

TOTAL: 45 HOURS

1. Brian W. Kernighan, Dennis Ritchie, "The C Programming Language", Second Edition, Pearson Education, 2015.
2. TanaenbaumA.S.,Langram Y. Augestein M.J " Data Structures using C" Pearson Education , 2004.
3. Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Second Edition, Pearson Education, 1997.
4. Y. Langsam, M. J. Augenstein, A. M. Tenenbaum, "Data Structures using C", Pearson Education Asia, 2004.
5. Robert Kruse & Bruce Leung, "Data Structures & Program Design in C", Pearson Education, 2007.

SEMESTER II

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3505	Data Communication and Networks Programming	3	1	0	4
2.	CA3506	Object Oriented Programming Using Java	3	1	0	4
3.	CA3507	Problem Solving Using Python	3	0	0	3
4.	CA3508	Software Engineering	3	0	0	3
5.	E-I	Elective -1	3	0	0	3
6.	E-II	Elective –2	3	0	0	3
PRACTICAL						
7.	CA3573	Python Programming Laboratory	0	0	2	2
8.	CA3574	Java Programming and Networks Laboratory	0	0	2	2
TOTAL			18	4	4	**24**

CA3505	DATA COMMUNICATION AND NETWORKS PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVES

- To understand the network fundamentals.
- To explore various application layer protocols.
- To understand the transport layer services.
- To learn the network layer functionalities.
- To understand the link layer services and data communication fundamentals.

	Course Outcome	Cognitive Skill
CO-01	Describe the fundamentals of internetworking.	R,U
CO-02	Study the functionalities of DDL and its protocols	R,U
CO-03	Study the functionalities of network layer and its protocols	R,U
CO-04	Study the functionalities of transport layer and its protocols	R,U
CO-05	Study the functionalities of application layer and its protocols	R,U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	L	L	L	L	L	L	N	M	N	N	M	N	M
CO-02	M	M	M	M	L	L	N	M	N	N	M	N	M
CO-03	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-04	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-05	M	M	M	M	L	L	M	M	N	N	M	N	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: FUNDAMENTALS OF DATA COMMUNICATION 9

Communication Model – Data communications – Data Transmission: Concepts and Terminology, Analog and Digital Transmission, Transmission Impairments – Signal Encoding Techniques: Digital Data and Digital Signals – Multiplexing: FDM, TDM, Multiple Channel Access.

UNIT II: DATA LINK LAYER 9

Hardware Building Blocks: Nodes, Links – Link Layer Functions – Framing: PPP, HDLC – Error Detection: Two Dimension Parity, Checksum, CRC – Reliable Transmission: Stop and Wait, Sliding Window – MAC: Ethernet, WiFi.

UNIT III : NETWORK LAYER 9

Network Layer Functions – Switching and Forwarding: Datagrams, Virtual Circuit Switching, Source Routing – Internetworking: IPv4, IP Address Classes, Subnetting, CIDR, ARP, DHCP, ICMP – Routing: DVR, LSR, BGP – IPv6.

UNIT IV: TRANSPORT LAYER **9**

Transport Layer Services – UDP – Reliable Byte Stream: TCP, Connection Establishment and Termination, Sliding Window, Triggering Transmission, Adaptive Retransmission, TCP Extensions – TCP Congestion Control.

UNIT V: APPLICATION LAYER **9**

Principles of Network Applications – Protocol Architecture: TCP/IP Protocol Architecture – Introduction to Socket Programming – Web and HTTP – File Transfer Protocol – Domain Name System – SMTP – POP – IMAP – Peer to Peer Applications – Performance: Latency, Delay and Bandwidth Product.

L: 45 + T: 15 = TOTAL: 60 HOURS

REFERENCES:

1. James F. Kurose, Keith W. Ross, "Computer Networking: A Top-Down Approach", Seventh Edition, Pearson Education, 2017.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A Systems Approach", Fifth Edition, Morgan Kaufmann Publishers, 2011. William Stallings, "Data and Computer Communications", Tenth Edition, Pearson, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, "Computer Networks: An Open Source Approach", McGraw-Hill, 2012.

CA3506	OBJECT ORIENTED PROGRAMMING USING JAVA	L	T	P	C
		3	1	0	4

OBJECTIVES

- To study the practical–implementations of object-oriented concepts in Java programming.
- To work with Generics, networking and GUI based application development.
- To develop dynamic web applications with database connectivity using server-side technologies.
- To create distributed applications using RMI, Java Bean and web services.
- To understand the importance of advanced frameworks.

Course Outcome		Cognitive Skill
CO-01	To understand, analyse, interpret and review basic concepts of Java and its object orientation concept.	R, U, An, E
CO-02	To get expertise in window-based programming, including AWT, and Event models.	An, A, S
CO-03	To analyse, review and synthesis the built-in packages of java and to use the features of networking.	An, E, S
CO-04	Able to explore solutions for database connectivity, distributed programming and BDK.	A, S
CO-05	Able to explore distributed object concepts and advanced frameworks	R, U, An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	M	L	M	S	S	M	M	L	M	M	L
CO-02	S	M	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	S	S	M	M	M	M	M	S	S	M	M	M
CO-04	S	L	M	M	M	S	M	M	M	M	M	M	L
CO-05	S	L	S	M	L	M	L	S	S	M	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: JAVA AND OBJECT ORIENTATION 9

Object Oriented Concepts in Java: JavaFeatures – Java Platform – Java Fundamentals – Data Types, Variables, and Arrays – Expressions, Operators, and Control Structures – Classes, Packages and Interfaces - Inner Classes – Exception Handling, Generic Collections – Generic Classes and Methods.

UNIT II: WINDOW FUNDAMENTALS 9

Applet – Applet Basics, Architecture, Skeleton; Painting; AWT Package – Controls, Layouts– Containers – Event Package – Event Model, Event Classes, Event Listener, Adapter Classes - Garbage Collection -Reflection.

UNIT III: PACKAGES AND APPLICATION DEVELOPMENT 9

Language Packages– Utility Packages – Collection Framework, Utility Classes - Input Output Packages – File, Stream Classes, Byte Streams, Character Streams, Serialization - Multithreaded Programming –Networking-Manipulating URLs – Reading Web Pages – Using Stream Sockets – Datagrams – Broadcasting – Multicasting – Chat Application.

UNIT IV: JDBC AND WEB APPLICATION DEVELOPMENT 9

Accessing Database with JDBC – Basics – Manipulating Databases with JDBC – Overviewof Servlets – Servlet API – Servlet Life Cycle – Servlet Configuration – Running Servlet withDatabase Connectivity – Session Tracking – Fundamentals of JSP, JFS –MVC Architecture.

UNIT V: DISTRIBUTED OBJECTSAND ADVANCED FRAMEWORKS 9

RMI Programming Model – Remote Object Activation – Java Beans Component – JavaBeans API – Java Messaging Services (JMS) – Synchronous and Asynchronous Messaging– Java Mail API – Java Web Services. Understanding Struts – Hibernate –Spring Framework –Case Studies.

L: 45 + T: 15 = TOTAL: 60 HOURS

REFERENCES:

1. "Core and Advanced Java, Black Book", Dreamtech Press, 2018.
2. Paul J. Deitel, Harvey Deitel, "Java How to Program", Eleventh Edition, Pearson,2017.
3. Cay S. Horstmann, "Core Java Volume I & II", Pearson Education, 2018.

4. Herbert Schildt , “Java The Complete Reference”, Eighth Edition, Tata McGraw Hill,2011.
5. Paul Dietel, Harvey Dietel, Abbey Dietel, “Internet and World Wide Web”, FifthEdition, Pearson Education, 2012.

CA3507	PROBLEM SOLVING USING PYTHON	L	T	P	C
		3	0	0	3

OBJECTIVES

- To know the basics of algorithmic problem solving.
- To develop Python programs with conditionals and loops.
- To define Python functions and use function calls.
- To use Python data structures – lists, tuples, dictionaries.
- To do input/output with files in Python.

Course Outcome		Cognitive Skill
CO-01	To know the basics of algorithmic problem solving.	R
CO-02	To develop python programs with conditionals and loops and functions.	A, U
CO-03	To use python data structures – list, tuples and sets.	A, E
CO-04	To use python data structures – Dictionary and the functions of strings and modules.	A, An, E
CO-05	To do input/output with files in python.	A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	S	S	S	S	S	L	S	M	S	S	S	S
CO-02	S	S	S	S	S	S	L	S	M	S	M	M	S
CO-03	S	S	S	S	S	S	M	S	M	S	S	M	S
CO-04	S	S	S	S	S	S	L	S	M	S	S	M	S
CO-05	S	S	S	S	S	S	L	S	M	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTRODUCTION TO COMPUTING AND PROBLEM SOLVING 9

Fundamentals of Computing – Computing Devices – Identification of Computational Problems – Pseudo Code and Flowcharts – Instructions – Algorithms – Building Blocks of Algorithms – Introduction to Python Programming – Python Interpreter and Interactive Mode– Variables and Identifiers – Arithmetic Operators – Values and Types – Statements

UNIT II: CONDITIONALS AND FUNCTIONS 9

Operators – Boolean Values – Operator Precedence – Expression – Conditionals: If-Else Constructs – Loop Structures/Iterative Statements – While Loop – For Loop – Break Statement – Function Call and Returning Values – Parameter Passing – Local and Global Scope – Recursive Functions.

UNIT III: SIMPLE DATA STRUCTURES IN PYTHON 9

Introduction to Data Structures – List – Adding Items to a List – Finding and Updating an Item – Nested Lists – Cloning Lists – Looping Through a List – Sorting a List – List Concatenation – List Slices – List Methods – List Loop – Mutability – Aliasing – Tuples: Creation, Accessing, Updating, Deleting Elements in a Tuple, Tuple Assignment, Tuple as Return Value, Nested Tuples, Basic Tuple Operations – Sets.

UNIT IV: STRINGS, DICTIONARIES, MODULES 9

Strings: Introduction, Indexing, Traversing, Concatenating, Appending, Multiplying, Formatting, Slicing, Comparing, Iterating – Basic Built – In String Functions – Dictionary: Creating, Accessing, Adding Items, Modifying, Deleting, Sorting, Looping, Nested Dictionaries Built – in Dictionary Function – Finding Key And Value in a Dictionary – Modules: Introduction – Module Loading and Execution – Packages – Making Your Own Module – The Python Standard Libraries.

UNIT V: FILE HANDLING AND EXCEPTION HANDLING 9

Files: Introduction – File Path – Opening and Closing Files – Reading and Writing Files – File Position – Exception: Errors and Exceptions, Exception Handling, Multiple Exceptions.

TOTAL: 45 HOURS

REFERENCES:

1. Reema Thareja, “Python Programming using Problem Solving Approach”, Oxford University Press, 2017.
2. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist”, Second Edition, Shroff/O‘Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/).
3. Guido van Rossum, Fred L. Drake Jr., “An Introduction to Python – Revised and Updated for Python 3.2”, Network Theory Ltd., 2011.
4. John V Guttag, “Introduction to Computation and Programming Using Python”, Revised and Expanded Edition, MIT Press , 2013
5. Charles Dierbach, “Introduction to Computer Science using Python”, Wiley India Edition, 2016.
6. Timothy A. Budd, “Exploring Python”, Mc-Graw Hill Education (India) Private Ltd., 2015.
7. Kenneth A. Lambert, “Fundamentals of Python: First Programs”, Cengage Learning, 2012.

CA3508	SOFTWARE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To discuss software engineering concept basic steps to develop software.
- To discuss the concept of requirement analysis, developing use cases and building analysis models.
- To discuss the design models and its analysis.
- To explain the different software testing methods and its usage
- To define the software quality assurance, Reliability and Quality standards.

Course Outcome		Cognitive Skill
CO-01	To know about software engineering concept basic steps to develop software.	R,U
CO-02	To know about the concept of requirement analysis, developing use cases and building analysis models.	R,U,An
CO-03	To know the design models and its analysis.	R,U,A
CO-04	To study the different software testing methods and its usage	A,An,E
CO-05	To define the software quality assurance, Reliability and Quality standards.	A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M
CO-04	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : INTRODUCTION 9

A Generic View of Process – Process Models-The Waterfall Model-Incremental Model- Spiral Model-Software Cost Estimation – Planning – Risk Analysis – Software Project Scheduling.- Rapid Prototyping.

UNIT II: REQUIREMENT ANALYSIS 9

System Engineering Hierarchy – System Modeling – Requirements Engineering: Tasks-Initiating

The Process-Eliciting Requirements-Developing Use Cases-Negotiating Requirements-Validating Requirements – Building the Analysis Models: Concepts

UNIT III : SOFTWARE DESIGN **9**

Design Concepts – Design Models– Architectural Design –Component Level Design – object oriented design-Class Based And Conventional Components Design– User Interface – Analysis And Design

UNIT IV: SOFTWARE TESTING **9**

Software Testing – Strategies: Conventional - Object Oriented – Validation Testing – Criteria– Alpha – Beta Testing- System Testing – Recovery – Security – Stress – Performance -Testing Tactics – Testing Fundamentals-Black Box – White Box – Basis Path-Control Structure

UNIT V: SCM AND QUALITY ASSURANCE **9**

Software Configuration And Management-Features-SCM Process-Software Quality Concepts – Quality Assurance – Software Review–Technical Reviews – Formal Approach To Software Quality Assurance – Reliability – Quality Standards – Software Quality Assurance Plan

TOTAL: 45 HOURS

REFERENCES

1. Rohit Khurana,” Software Engineering: Principles and Practices ”, Second edition, VIKAS Publishing House PVT Ltd,2007
2. Roger Pressman.S., “Software Engineering: A Practitioner's Approach”, 7thEdition,Mcgraw Hill, 2010.
3. I. Sommerville, “Software Engineering” , 9thEdition: Addison Wesley, 2011.
4. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, “Fundamentals of Software Engineering”,Prentice Hall Of India 1991.

CA3573	PYTHON PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	2

OBJECTIVES

- To understand the problem solving approaches.
- To learn the basic programming constructs in Python.
- To articulate where computing strategies support in providing Python-based solutions to real world problems.
- To use Python data structures - lists, tuples, dictionaries.
- To do input/output with files in Python.

Course Outcome		Cognitive Skill
CO-01	To execute simple python programs.	E
CO-02	To develop python programs with conditionals and loops and functions.	A, E
CO-03	To use python data structures – list, tuples and sets.	A, E

CO-04	To use python data structures – Dictionary and the functions of strings and modules.	A, An, E
CO-05	To do input/output with files in python.	A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	S	S	S	S	S	L	S	M	S	S	S	S
CO-02	S	S	S	S	S	S	L	S	M	S	M	M	S
CO-03	S	S	S	S	S	S	M	S	M	S	S	M	S
CO-04	S	S	S	S	S	S	L	S	M	S	S	M	S
CO-05	S	S	S	S	S	S	L	S	M	S	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS:

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same.
2. Python programming using simple statements and expressions.
3. Scientific problems using Conditionals and Iterative loops.
4. Practical - Implementing real-time/technical applications using Lists, Tuples.
5. Practical - Implementing real-time/technical applications using Sets, Dictionaries.
6. Practical - Implementing programs using Functions.
7. Practical - Implementing programs using Strings.
8. Practical - Implementing programs using written modules and Python Standard Libraries.
9. Practical - Implementing real-time/technical applications using File handling.
10. Practical - Implementing real-time/technical applications using Exception handling.
11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL: 45 HOURS

		L	T	P	C
CA3574	**JAVA PROGRAMMING AND NETWORKS LABORATORY**	**0**	**0**	**2**	**2**

OBJECTIVES

- To understand and apply the fundamentals of core Java.
- To implement inheritance, polymorphism, interfaces, multithreading, streaming, networking, generic collections and RMI.
- To develop web applications using client side and server-side programming.
- To understand SOAP and REST based web service standards.
- To learn and use MVC architecture for application development.

Course Outcome		Cognitive Skill
CO-01	To apply the fundamentals of core Java.	A
CO-02	To implement inheritance, polymorphism, interfaces and multithreading.	E
CO-03	To implement streaming, generic collections and RMI.	A, E
CO-04	To develop web applications using client side and server-side programming.	An, E
CO-05	To understand SOAP and REST based web service standards	A, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	S	S	S	S	S	S	S	M	S	S	S	S
CO-02	S	S	S	M	S	S	L	S	S	S	M	M	S
CO-03	S	S	S	M	S	S	M	S	M	S	S	M	S
CO-04	S	S	S	M	S	S	S	S	M	S	S	M	S
CO-05	S	S	S	M	S	S	S	L	M	M	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS:

1. Design and Implement java programs that deals with the following:
    a. Classes and Objects and Interfaces.
    b. Exception Handling with user defined Exceptions.
    c. String Handling (String Class objects – string manipulation functions).
    d. Streaming (image file handling using byte streams – text file manipulation using character streams).
    e. Implementation of Thread Synchronization using any application.
    f. Reading and Writing Objects using Serialization.
    g. Creation of User Interfaces using SWING and graphic features.
    h. Creation and Manipulation of generic objects.
2. Java socket programming.
    a. Implementation of chat client-server application.
    b. Implementation of simple http client/server application.
    c. Simulation of DNS protocol.
3. Reading websites using URL class.
4. Implementation of any Information System using JDBC.
5. Remote Method Access using RMI Implementation.
6. Database Connectivity using Java Bean.
7. Web Application development using Servlet, JSP and JSF.
8. Session Management and Implementation of Cookies using JSF.
9. Development of SOAP and REST based web services.

10. Development of Hibernate framework-based application for O/R mapping.
11. Web application development using Struts framework & Spring framework.
12. Analyze live HTTP/DNS/UDP/TCP/IP/ICMP/DHCP packets using Wireshark tool.

TOTAL: 45 HOURS

REFERENCES:

1. "Core and Advanced Java, Black Book", Dreamtech Press, 2018.
2. Paul J. Deitel, Harvey Deitel, "Java How to Program", Eleventh Edition, Pearson,2017.
3. Cay S. Horstmann, "Core Java Volume I & II", Pearson Education, 2018.
4. Herbert Schildt , "Java The Complete Reference", Eighth Edition, Tata McGraw Hill,2011.
5. Paul Dietel, Harvey Dietel, Abbey Dietel, "Internet and World Wide Web", FifthEdition, Pearson Education, 2012.

SEMESTER - III

SL.NO	COURSE CODE	COURSE TITLE	L	T	P	C
THEORY						
1.	CA3509	Data Science and Cloud Computing	3	1	0	4
2.	CA3510	Visual Programming	3	1	0	4
3.	E-III	Elective –3	3	0	0	3
4.	E-IV	Elective – 4	3	0	0	3
5.	E-V	Elective –5 (Open Elective)	3	0	0	3
PRACTICAL						
6.	CA3575	Visual Programming Laboratory	0	0	2	2
7.	CA35P1	Project Work – Phase I	0	0	12	6
TOTAL			15	3	14	**22**

CA3509	DATA SCIENCE AND CLOUD COMPUTING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To know the fundamental concepts of data science and applications
- To study the concepts of data science analytics
- To know the basics of cloud computing
- To study about virtualization and its techniques
- To know about cloud resource management and its issues

	Course Outcome	Cognitive Skill
CO-01	To know the fundamental concepts of data science and applications	R,U
CO-02	To study the concepts of data science analytics	R,U,An
CO-03	To know the basics of cloud computing	R,U,A
CO-04	To study about virtualization and its techniques	A,An,E
CO-05	To know about cloud resource management and its issues	A,An,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	L	L	M	M	S	N	M	N	M	M	N	M
CO-02	S	S	M	S	M	S	N	S	N	M	S	N	M
CO-03	M	S	M	M	M	S	M	M	N	M	M	N	M
CO-04	S	S	M	S	M	S	M	S	N	M	S	N	M
CO-05	S	S	M	S	M	S	M	S	N	M	S	N	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I INTRODUCTION TO DATA SCIENCE **9**

Introduction to Data Science – Need for Data Science – Facets of data - Prerequisite for Data Science - Components - Tools for Data Science - Data Science Lifecycle -Applications - Data Science Process: Setting the research goal - Retrieving data - Data preparation - Data exploration - Data modelling - Presentation and automation. Big data ecosystem and data science – Data Science operating Models – Guiding principles.

UNIT II DATA ANALYTICS 9

Classes of analytic Techniques – Analytic Learning Models – Analytic Execution Models – Fractal analytic Model – The analytic selection process – Spoofed domain problem decomposition - Balancing analytic dimensions – Feature engineering - Feature selection - Data veracity - Curse of dimensionality - Model validation.

UNIT III INTRODUCTION TO CLOUD 9

Cloud Computing Overview – Origins of Cloud computing – Cloud components - Essential characteristics - Roots of Cloud Computing – Service models and Deployment Model: Public Clouds – Private Clouds – Community Clouds - Hybrid Clouds - Advantages of Cloud Computing.–Features - Infrastructure Management - IaaS – PaaS –SaaS - Challenges and Risk.

UNIT IV VIRTUALIZATION TECHNIQUES 9

Introduction to Virtual Machines – Benefits - Levels of Virtualization -Emulation: Virtualization at OS level - Virtualization structure - mechanisms - open source virtualization technology - Xen virtualization architecture - Full virtualization - Para virtualization – virtualization of CPU, Memory and I/O devices - Hardware Support - processor virtualization.

UNIT V CLOUD RESOURCES MANAGEMENT AND ISSUES 9

Cloud architecture: Cloud delivery model, Cloud Storage Architectures, Software as a Service (SaaS): SaaS service providers – Google App Engine, Salesforce.com and google platform – Benefits – Operational benefits - Economic benefits – Evaluating SaaS – Platform as a Service (PaaS): PaaS service providers – Right Scale – Salesforce.com – Rackspace – Force.com –

Services and Benefits – Infrastructure-as-a -Service (IaaS): IaaS Service Providers – Amazon EC2.

TOTAL : 45 Periods

REFERENCES:

1. Rachel Schutt, Cathy O'Neil, "Doing Data Science", O'Reilly Publishers, 2013.
2. Davy Cielen, Arno D. B. Meysman, and Mohamed Ali, "Introducing Data Science, Big data, machine learning, and more, using Python tools"Publisher: Dream tech Press January2016.
3. Booz, Allen, Hamilton "The field guide to data science" eBookSocial Science Electronic Publishing, April 2011, Web.
4. Cloud computing principles and paradigms by RajKumarBuyya, James Broberg,AndrzejGoscinski, Wiley India Pvt Ltd, Delhi 2011
5. Cloud computing Black book by KailashJayaswal,JegannathKallakurchi, Donald J. Houde, Dr.Devan Shah, KogentLearnig solutions Inc, 2014
6. Kai Hwang, Geofrey C. Fox and Jack J. Dongarra, Distributed and Cloud Computing, Morgan Kaufmann, 2012.

CA3510	VISUAL PROGRAMMING	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To Study in detail about Windows Programming
- To Study fundamental programming concept of Visual Basic 2010
- To Study the controls supported by Visual Basic 2010
- To Study the concept of backend support in Visual Basic 2010
- To Study how to develop the applications in Visual Basic 2010

Course Outcome		Cognitive Skill
CO-01	To Study in detail about Windows Programming	R,U
CO-02	To Study fundamental programming concept of Visual Basic 2010	R,U,A
CO-03	To Study the controls supported by Visual Basic 2010	R,U,A
CO-04	To Study the concept of backend support in Visual Basic 2010	R,U,A
CO-05	To Study how to develop the applications in Visual Basic 2010	R,U,A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	L	L	M	M	M	N	M	N	N	M	N	M
CO-02	S	S	M	S	M	M	N	S	N	N	S	N	M
CO-03	M	S	M	M	M	M	M	M	N	N	M	N	M
CO-04	S	S	M	S	M	M	M	S	N	N	S	N	M
CO-05	S	S	M	S	M	M	M	S	N	N	S	N	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I EXPLORING THE INTEGRATED DEVELOPMENT ENVIRONMENT 9

Project – Form designer - Understanding the IDE Components: IDE Menus - IDE Windows - Setting Environment Options - Building a Console Application – Variables - Types of Variables - Variable options - Converting Variable Types - Widening and Narrowing Conversions - Formatting Numbers - Numeric Format Strings - User-Defined Data Types -Variable's Scope - Variable's Lifetime – Constants – Arrays – Collections

UNIT II VISUAL BASIC PROGRAMMING ESSENTIALS 9

Flow-Control Statements: Decision Statements - Loop Statements - Exit and Continue – Procedures – Subroutines – Functions – Arguments - Argument-Passing Mechanisms - Built-in Functions - Custom Functions - Named Arguments - Functions Returning Arrays - Overloading Functions - Documenting Functions

UNIT III BASIC WINDOWS CONTROLS 9

TextBox Control, ListBox, CheckedListBox, and ComboBox Controls, ScrollBar and TrackBar Controls-Working with Forms-Appearance of Forms-Anchoring and Docking-Splitting Forms into Multiple Panes-Form Events-Loading and Showing Forms-Sharing Variables between Forms-Forms versus Dialog Boxes-Building Dynamic Forms at Runtime-DesigningMenus- Programming Menu Commands-Using Access and Shortcut Keys-Manipulating Menus at Runtime.

UNIT IV ADVANCED WINDOWS CONTROLS 9

Common Dialog Controls: Font Dialog Control – Open Dialog and Save Dialog Controls –Folder Browser Dialog Control – Rich Text Box Control: Advanced Editing Features - File Menu - Edit Menu - Format Menu - Search & Replace Dialog Box – Tree View Control: Adding Nodes – List View Control: Columns Collection – List View Items and Sub items - Items Collection - Sub Items Collection - Processing Selected Items.

UNIT V DATA PROCESSING 9

Storing Data in Data Sets - Filling Data Sets – Data Adapter Class – Command Builder Class - Accessing the Data Set's Tables - Performing Update Operations - Updating the Database with the Data Adapter - Working with Typed Data Sets - Generating a Typed Data Set - Exploring the Data Set - Data Binding - Designing Data-Driven Interfaces - Binding Hierarchical Tables – Binding Source as a Data Source – Data Grid View Control - Displaying Lookup Columns in a Data Grid View Control - Editing and updating the Data in Hierarchical Tables - Viewing the Deleted Rows

Text Book:

Mastering MicrosoftVisual Basic2010 by EvangelosPetroutsos, Wiley Publishing, Inc,2010

REFERENCES:

1. MicrosoftVisual Basic2010 step by step by Michael HarvosenMicrosoft Press 2010
2. Programming in Visual Basic 2010 The Very Beginner's Guide by Jim McKeown Dakota State University, CAMBRIDGE UNIVERSITY PRESS 2010
3. Microsoft Visual Basic 2010 Developer's Handbook by Klaus Löffelmann, Sarika CallaPurohit – 2010

CA3575	VISUAL PROGRAMMING LABORATORY	L	T	P	C
		0	0	2	2

OBJECTIVES:

- To develop applications using Graphical User Interface tools.
- To understand the design concepts
- To implement the applications using basic VB2010 controls.
- To implement the applications using advanced controls in VB2010.
- To implement the applications using database connectivity.

Course Outcome		Cognitive Skill
CO-01	Develop an application using forms and functions	A
CO-02	Develop an application using menu editor and different data types	A
CO-03	Develop an application in VB using windows controls and dialog controls	A
CO-04	Develop an application in VB using rich text box and file system	A
CO-05	Develop an application in VB using data grid and database manipulation	A

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	L	L	M	M	M	N	M	N	N	M	N	M
CO-02	S	S	M	S	M	M	N	S	N	N	S	N	M
CO-03	M	S	M	M	M	M	M	M	N	N	M	N	M
CO-04	S	S	M	S	M	M	M	S	N	N	S	N	M
CO-05	S	S	M	S	M	M	M	S	N	N	S	N	M

S- Strong, M- Medium, L-Low, N- Not Relevant

LIST OF EXPERIMENTS:

1. Form Design – Keyboard & Mouse events
2. Application development using user defined functions.
3. Programs on usage of data types - variant, Control arrays
4. Application development using menu editor.
5. Application development using basic windows controls.
6. Application development using dialog control.
7. Application development using rich text box control.
8. Simple applications using file system controls
9. Database application development using data grid view control.
10. Database application development for database manipulation.

TOTAL: 45 HOURS

REFERENCES:

1. Mastering Microsoft Visual Basic 2010 by vangelos Petroutsos, Wiley Publishing,Inc,2010
2. MicrosoftVisual Basic2010 step by step by Michael Harvosen Microsoft Press 2010
3. Microsoft Visual Basic 2010 Developer's Handbook by Klaus Löffelmann, Sarika CallaPurohit – 2010

<table>
<tr><td rowspan="2">CA35P1</td><td rowspan="2">PROJECT WORK-PHASE I</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>12</td><td>6</td></tr>
</table>

OBJECTIVE:

- Opportunity to specialize in specific areas of computer science;
- Future employers will most likely ask about the project at interview;
- Opportunity to demonstrate a wide range of skills and knowledge learned
- Encourages integration of knowledge gained in the previous course units.

The Project Work-I is not only a part of the coursework, but also a mechanism to demonstrate the abilities and specialization. It provides the opportunity for the student to demonstrate originality, teamwork, inspiration, planning and organization in a software project, and to put into practice some of the techniques that have been taught throughout the previous courses. Mini Project work shall be carried out by a student under the guidance of a faculty. It is mandatory that a Student should submit the document of the completed work in the midsemester and presentation before the project course committee during the semester in which the mini project work is undertaken. The students could demonstrate that he/she has acquired both analytical and practical skills in the field specialization. The student should submit the mini project report at the end of the semester. The project report should be documented with an engineering approach to the solution of the problem .The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards.

SEMESTER IV

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
1.	CA35P2		0	0	36	18
TOTAL			0	0	36	18

		L	T	P	C
CA35P2	**Project Work – Phase II**	**0**	**0**	**36**	**18**

OBJECTIVE:

Student is expected to do an in depth study in his/her specialized area by doing a detailed literature survey, understanding different aspects of the problem, arriving at the status report in the area, carry out developmental and/or experimental Work, analyze and interpret the results to arrive the conclusions.

Project work is an inclusive component of a Program. Project work shall be carried out by a student under the guidance of a faculty either within the University department(s) or in external organizations like Industries, Research Institutes/Centers or other Academic Institutions recognized by the appropriate statutory bodies and approved by the Board of Management. In case of external organizations, a co-guide from such institutions is essential. The guide/co-guide may be from other related departments of the University also. Guide/co-guide is normally fixed by mutual consent but recommended by the HOD and approved by the Dean. In the Project Work, Student is expected to do an in depth study in his/her specialized area by doing a detailed literature survey, understanding different aspects of the problem, arriving at the status report in the area, carry out developmental and/or experimental Work, analyze and interpret the results to arrive the conclusions. Project presentations are inclusive components of a program. These presentations are based on learnt investigation methodologies, concepts and techniques from the available relevant research literature, etc., critical correlation of work of various authors/researchers and results pertaining to the project work and their analysis. The student should demonstrate that he/she has acquired both analytical and practical skills in the field specialization. Interdisciplinary projects are also encouraged. Project may be applied research or industry oriented or a combination of both.

LIST OF ELECTIVES

SL. NO	COURSE CODE	COURSE TITLE	L	T	P	C
ODD SEMESTER ELECTIVES						
1.	CA35A1	Software Reuse	3	0	0	3
2.	CA35A2	Software Reliability and Metrics	3	0	0	3
3.	CA35A3	Human Resource Management	3	0	0	3
4.	CA35A4	Advanced Soft Computing	3	0	0	3
5.	CA35A5	Knowledge Engineering	3	0	0	3
6.	CA35A6	Digital Image Processing	3	0	0	3
7.	CA35A7	Software Testing	3	0	0	3
8.	CA35A8	User Interface Design	3	0	0	3
9.	CA35A9	Service Oriented Architecture	3	0	0	3
10.	CA35B1	Information Storage Management	3	0	0	3
11.	CA35B2	System Software Internals	3	0	0	3
12.	CA35B3	Bio Informatics	3	0	0	3
13.	CA35B4	Management Information System	3	0	0	3
14.	CA35B5	Software Risk Management and Maintenance	3	0	0	3
15.	CA35B6	Wireless Networks	3	0	0	3
16.	CA35B7	Virtualization Techniques	3	0	0	3
17.	CA35B8	Big Data Analytics	3	0	0	3
EVEN SEMESTER ELECTIVES						
18.	CA35B9	Ad-Hoc Networks	3	0	0	3
19.	CA35C1	Machine Learning Techniques	3	0	0	3
20.	CA35C2	Multimedia Databases	3	0	0	3
21.	CA35C3	Artificial Intelligence Techniques	3	0	0	3
22.	CA35C4	Software Requirements Management	3	0	0	3
23.	CA35C5	Cyber Forensics	3	0	0	3
24.	CA35C6	Mobile Communication Techniques	3	0	0	3
25.	CA35C7	Principles of Compiler Design	3	0	0	3
26.	CA35C8	Information System Security	3	0	0	3
27.	CA35C9	Internet of Things	3	0	0	3
28.	CA35D1	Cryptography And Network Security	3	0	0	3
29.	CA35D2	Software Project Management	3	0	0	3
30.	CA35D3	Data Mining and Data Warehousing	3	0	0	3

ODD SEMESTER ELECTIVES

CA35A1	SOFTWARE REUSE	L	T	P	C
		3	1	0	4

OBJECTIVES:

- To explain the benefits of software reuse and some reuse problems.
- To discuss several different ways to implement software reuse.
- To describe the development of Software product lines.
- To understand the metrics used in software reusable components.
- To develop reusable components.

Course Outcome		Cognitive Skill
CO-01	To understand, analyse, interpret and review the enterprise reuse process and its business processes.	R, U, An, E
CO-02	To recognize, design, analyse and implement the advanced engineering process of software development with layered architecture.	U, E, An, A
CO-03	To get expertise in components-based software development by implementing the idea of variability.	An, A, S
CO-04	To analyse, review and criticize the comprehensive reuse process along with AFE and Business Engineering.	An, E, S
CO-05	Able to explore solutions for transition to reuse business, with research intentions on reuse-based software engineering business.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M
CO-04	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

.UNIT-I INTRODUCTION 9

Software Reuse success Factors- Change in process - Change in Organization-set of PrinciplesReuse Cost effective-software Engineering Processes- Establishing and Managing a Reuse business.

UNIT-II OBJECT-ORIENTED SOFTWARE ENGINEERING 9

Transform requirement into code- Use Case model-Analysis model-Design model Implementation Model-Test Model-Application and Component Systems- Layered Architecture.

UNIT-III COMPONENTS 9

Use case Components-Structure the use case model to ensure component reuse- Reusing Component to build the use case model-Design the use case components for effective reuse Expressing use case Variability- Packaging and Documenting use case components objects Components.

UNIT-IV REUSE PROCESSES 9

Object-oriented Business Engineering-Applying Business Engineering-Applying Business engineering to Define process and organization- Application family Engineering.

UNIT-V REUSE IN BUSINESS 9

Organizing a Reuse Business- Transition to a Reuse Business- Managing the reuse businessMaking the reuse Business work. Applications of reuse in business.A case study of reuse inbusiness.

TOTAL: 45 HOURS

REFERENCES:

1. Ivar Jacobson, Martin Gres, Patrick Johnson, "Software Reuse", Pearson Education, 2004.Elsevier, 5th edition, 2012.
2. Even-Andre Karisson, " Software Reuse , A Holistic Approach ", John Wiley and Sons,1996.
3. Karma McClure, " Software Reuse Techniques ,Additional reuse to thesystems development process ", Prentice Hall, 1997.
4. Themistoklis Diamantopoulos and Andreas L.Symeonidis "Mining software EngineeringData For Software Reuse", Ist edition,30 March 2020.

CA35A2	SOFTWARE RELIABILITY AND METRICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Fundamentals of software reliability
- To understand software reliability modelling.
- To apply engineering knowledge and specialist techniques to prevent frequency of failures.
- To Study the fundamentals of measurement
- To study about product metrics

Course Outcome		Cognitive Skill
CO-01	To learn Fundamentals of software reliability	R, U, An, E
CO-02	To understand software reliability modeling.	U, E, An, A
CO-03	To apply engineering knowledge and specialist techniques to prevent frequency of failures.	An, A, S
CO-04	To Study the fundamentals of measurement	An, E, S
CO-05	To study about product metrics	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	S	S	L	M	S	S	M	S	S	M	M	L
CO-02	S	M	L	S	S	M	L	M	M	L	M	S	M
CO-03	M	M	L	S	M	M	L	M	S	M	S	L	M
CO-04	M	S	S	L	M	S	S	M	S	S	M	M	L
CO-05	L	M	L	M	L	M	L	S	M	L	S	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I FUNDAMENTAL TO SOFTWARE RELIABILITY 9

Basic Concepts - Failure and Faults - Environment - Software reliability; Availability -Modeling - uses; Failure definition - Classification, Counting - System Configuration - test run selection Selection Strategy, Equivalence Partitioning.

UNIT-II SOFTWARE RELIABILITY MODELING 9

Concepts - General Model Characteristic - Historical Development of models - Model Classification scheme; Markovian models - General concepts - General Poisson Type Models Binomial Type Models - Poisson Type models - Fault reduction factor for Poisson Type models.

UNIT-III COMPARISON OF SOFTWARE RELIABILITY MODELS 9

Comparison Criteria - Failure Data - Comparison of Predictive Validity of Model Groups Recommended Models - Comparison of Time Domains; Calendar Time Modeling - Limiting Resource Concept - Resource Usage model - Resource Utilization - Calendar Time Estimation and confidence Intervals.

UNIT-IV MEASUREMENT THEORY 9

Measurements in Software Engineering - Scope of Software metrics -Representational Theory of Measurement - Measurement and Models - Measurement Scales and Scale Types - Goal based Framework - Software Measurement Validation.

UNIT-V PRODUCT METRICS 9

Measurement of Internet Product Attributes - Size and Structure - External Product Attributes - Measurement of Quality - Software reliability: measurement and prediction - Basics of reliability theory, The software reliability problem, Parametric reliability growth models - Model Evaluation.

TOTAL: 45 HOURS

REFERENCES:

1. John D. Musa, Anthony Iannino, KazuhiraOkumoto, "Software Reliability Measurement,Prediction, Application, Series in Software Engineering and Technology", McGraw Hill, 1987.
2. John D. Musa, "Software Reliability Engineering", Tata McGraw Hill, 1999.
3. Norman E . Fenton, Shari Lawrence Pfleeger, "Software metrics", Second Edition,International Student Edition, 2003.
4. Pavlov Nikolay ,"Some software reliability models",edition 2018.

<table>
<tr><td rowspan="2">CA35A3</td><td rowspan="2">HUMAN RESOURCE MANAGEMENT</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>0</td><td>3</td></tr>
</table>

OBJECTIVES:

- To understand the importance of human resources.
- To describe the steps involved in the human resource planning process
- To understand the stages of employee socialization and training needs
- To know about the purposes of performance management systems and appraisal.
- To know the list of occupational safety and health administration enforcement priorities.

Course Outcome		**Cognitive Skill**
CO-01	Understand the basic concepts, functions and processes of human resource management	R, U, An, E
CO-02	Know about the role, functions and functioning of human resource department of the organizations.	U, E, An, A
CO-03	Design and formulate various HRM processes such as Recruitment, Selection, Training, Development, Performance appraisals and Reward Systems, Compensation Plans and Ethical Behavior.	An, A, S

CO-04	Develop ways in which human resources management might diagnose a business strategy and then facilitate the internal change necessary to accomplish the strategy	An, E, S
CO-05	Evaluate the developing role of human resources in the global arena.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	L	M	S	S	M	S	S	M	S	M	S	S	L
CO-02	S	S	M	L	M	M	L	M	L	M	M	L	M
CO-03	S	M	M	L	M	M	L	M	L	M	M	L	M
CO-04	L	M	S	S	M	S	S	M	S	M	S	S	L
CO-05	M	L	M	L	S	M	L	S	L	S	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION TO HRM 9

Introduction- importance of HRM - functions- qualities of HR manager - evolution and growth of HRM - trends and opportunities - HRM in global environment - legal and ethical context laws for discriminatory practices - equal opportunity employment.

UNIT-II STAFFING, RECRUITMENT AND SELECTION 9

HR polices - need, type and scope - human resource planning - job analysis - recruiting goals - recruiting sources - global perspective - selection process - pre-employment testing-Interviews - job offers - hiring mistakes - key element for successful predictors.

UNIT-III TRAINING AND DEVELOPMENT 9

Socialization - new employee orientation, training, development - organizational development - methods - evaluating training - international training and development issues - career development - value for organization and individual - mentoring and coaching - traditional career stages.

UNIT-IV PERFORMANCE EVALUATION, REWARDS AND BENEFITS 9

Appraisal process - methods - factors distort appraisal - team appraisal - international appraisal - rewards - Theories of motivation - compensation administration - job evaluation and pay structure -special cases of compensation - executive compensation programs - employee benefits.

UNIT-V SAFE AND HEALTHY WORK ENVIRONMENT 9

Occupational safety and health act - issues - stress - assistance program - labor management - employee unions - labor legislation. Promotion, demotion, transfer and separation - employee grievances - redressal methods.

TOTAL: 45 HOURS

REFERENCES:

1. Decenzo and Robbins, Human Resource Management,Wilsey, 10th edition, 2012.

2. Mamoria C.B. and Mamoria. S., Personnel Management, Himalaya Publishing Company,1997.
3. Mirza S. Saiyadain Human Resource Management , Tata McGraw Hill , 4th edition 2009
4. EugenceMckenna and Nic Beach Human Resource Management, , Pearson EducationLimited, 2002.
5. Dessler, Human Resource Management, Pearson Education Limited, 2002. DecenzoandRobbins, Human Resource Management,Wilsey, 6th edition, 2001.
6. Wayne Cascio, Managing Human Resource, McGraw Hill, 1998.
7. Ivancevich, Human Resource Management, McGraw Hill 2002.
8. BiswajeetPattanayak, Human Resource Management, Prentice Hall of India, 3rd edition2005.
9. Gary Dessler ,BijuVarkkey,"Human Resource Management" ,Published in 2018,15th edition.

CA35A4	ADVANCED SOFT COMPUTING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn the key aspects of soft computing.
- To understand the feature of neural networks and its applications.
- To impart knowledge in Fuzzy Set Theory
- To learn Fundamentals of soft computing
- To understand soft computing techniques
- To Study the fundamentals of fuzzy systems

Course Outcome		Cognitive Skill
CO-01	Describe soft computing techniques and their roles in building intelligent machines	R, U, An, E
CO-02	Analyze various fuzzy models in developing fuzzy inference systems to be appropriate with specific real time problems	U, E, An, A
CO-03	Apply specific unsupervised and supervised neural networks to find approximate solutions to real world problem	An, A, S
CO-04	Use genetic algorithms to combinatorial optimization problems and Explain the behavior of evolutionary computing algorithms	An, E, S
CO-05	Present the feasibility of applying a soft computing methodology for specific problem	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	S	S	M	S	S	S	S	M	S	M	L
CO-02	L	M	M	L	M	M	L	M	L	M	L	M	M
CO-03	L	M	M	L	M	M	L	M	L	M	L	M	M
CO-04	S	M	S	S	M	S	S	S	S	M	S	M	L

CO-05	L	S	M	L	S	M	L	M	L	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Evolution of Computing - Soft Computing Constituents - From Conventional AI to Computational Intelligence - Neural Networks - Fuzzy Set Theory - Evolutionary Computation Neuro Fuzzy and Soft Computing Characteristics - Machine Learning Basics.

UNIT-II NEURAL NETWORKS 9

Machine Learning Using Neural Network, Adaptive Networks - Feed forward Networks Supervised Learning Neural Networks - Radial Basis Function Networks - Reinforcement Learning - Unsupervised Learning Neural Networks - Adaptive Resonance architectures Advances in Neural networks.

UNIT-III FUZZY LOGIC 9

Fuzzy Sets - Operations on Fuzzy Sets - Fuzzy Relations - Membership Functions-Fuzzy Rules and Fuzzy Reasoning - Fuzzy Inference Systems - Fuzzy Expert Systems - Fuzzy Decision Making.

UNIT-IV NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems - Coactive Neuro-Fuzzy Modeling - Classification and Regression Trees - Data Clustering Algorithms - Rulebase Structure Identification - Neuro-Fuzzy Control - Case studies.

UNIT-V APPLICATION OF COMPUTATIONAL INTELLIGENCE 9

Printed Character Recognition –Inverse Kinematics Problems-Automobile Fuel Efficiency Prediction-Soft Computing for Color Recipe Prediction.

TOTAL: 45 HOURS

REFERENCES:

1. Jyh-Shing Roger Jang, Chuen Tsai Sun, EijiMizutani, ”Neuro-Fuzzy and Soft Computing”,Prentice Hall of India, 2003.
2. George J. Klir and Bo Yuan, ”Fuzzy Sets and Fuzzy Logic-Theory and Applications”,Prentice Hall, 199
3. James A. Freeman and David M. Skapura, ”Neural Networks Algorithms, Applications,and Programming Techniques”, Pearson Edn., 2003.
4. Mitchell Melanie, ”An Introduction to Genetic Algorithm”, Prentice Hall, 1998.
5. David E. Goldberg, ”Genetic Algorithms in Search, Optimization and Machine Learning”,Addison Wesley, 1997.
6. S. N. Sivanandam, S. Sumathi and S. N. Deepa, ”Introduction to Fuzzy Logic usingMATLAB”, Springer, 2007.
7. S.N.SivanandamS.N.Deepa, ” Introduction to Genetic Algorithms”, Springer, 2007.
8. Jacek M. Zurada, ”Introduction to Artificial Neural Systems”, PWS Publishers, 1992.
9. I.A.Dhotre “Soft Computing”,Istedition,published in 2021.

CA35A5	KNOWLEDGE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn Fundamentals knowledge engineering
- To understand resolution and reasoning.
- To Study about representation
- To learn Fuzzy Logic
- To study about actions and planning

Course Outcome		Cognitive Skill
CO-01	Understand the knowledge-based systems representation.	R, U, E
CO-02	Understand the concepts of knowledge and its representation	U, E, An
CO-03	Understand automatic reasoning, inductive and deductive learning.	An, A
CO-04	Implement a small knowledge- based system.	An, S
CO-05	To familiarize with Fuzzy Logic and knowledge processing in expert systems	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	S	S	M	S	M	L	M	S	M	L
CO-02	L	L	M	M	L	M	L	M	M	M	L	M	M
CO-03	L	L	M	M	L	M	L	M	M	M	L	M	M
CO-04	S	S	M	S	S	M	S	M	L	M	S	M	L
CO-05	L	L	S	M	L	S	L	S	M	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Key concepts - Why knowledge Representation and Reasoning - Language of first order Logic Syntax, Semantics Pragmatics - Expressing Knowledge - Levels of Representation - Knowledge Acquisition and Sharing - Sharing Ontologies - Language. Ontologies -Language Patterns - Tools for Knowledge Acquisition.

UNIT-II RESOLUTION AND REASONING 9

Proportional Case - Handling Variables and Qualifies - Dealing with Intractability - Reasoning with Horn Clauses - Procedural Control of Reasoning - Rules in Production - Description Logic - Vivid Knowledge - Beyond Vivid.

UNIT-III REPRESENTATION 9

Object Oriented Representations - Frame Formalism - Structured Descriptions - Meaning and Entailment - Taxonomies and Classification - Inheritance - Networks - Strategies for Defeasible Inheritance - Formal Account of Inheritance Networks.

UNIT-IV DEFAULTS, UNCERTAINTY AND EXPRESSIVENESS 9

Defaults - Introduction - Closed World Reasoning - Circumscription - Default Logic Limitations of Logic - Fuzzy Logic – Non montonic Logic - Theories and World - Semiotics - Auto epistemic Logic - Vagueness - Uncertainty and Degrees of Belief – Non categorical Reasoning - Objective and Subjective Probability.

UNIT-V ACTIONS AND PLANNING 9

Explanation and Diagnosis - Purpose - Syntax, Semantics of Context - First Order Reasoning Modal Reasoning in Context - Encapsulating Objects in Context - Agents- Actions - Situational Calculus - Frame Problem - Complex Actions - Planning -Strips - Planning as Reasoning Hierarchical and Conditional Planning.

TOTAL: 45 HOURS

REFERENCES:

1. Ronald Brachman, Hector Levesque ”Knowledge Representation and Reasoning ”, TheMorgan Kaufmann Series in Artificial Intelligence 2004
2. John F.Sowa, ”Knowledge Representation: Logical, Philosophical, an Computational Foundations”, 2000
3. Arthur B. Markman, ”Knowledge Representation”, Lawrence Erlbaum Associates, 1998
4. Hamed Fazlollahtabar, “Knowledge Engineering The Process Paradigm”, First Edition, CRC Press, 2020.

CA35A6	DIGITAL IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Image Fundamentals and Processing Techniques
- To be familiar with Image Transformations in Spatial Domain and Frequency Domain
- To learn various Filters for Image Restoration
- To study various Image Compression and Segmentation Techniques
- To Learn different causes for image degradation and overview of image restoration techniques and also learn different feature extraction techniques for image analysis and recognition.

Course Outcome		Cognitive Skill
CO-01	To understand, analyze, interpret and review the fundamentals of Image processing	R, U, An, E
CO-02	To recognize, design, analyze and implement the process of Image Enhancement	U, E, An, A
CO-03	To get expertise in components-based Image Restoration process	An, A, S

CO-04	To analyse and review the Image segmentation process	An, E, S
CO-05	Able to explore solutions for Image compression process	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	M	S	M	S	L	M	M	L	M	M	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	L	M	M	S	M	S	S	M	L	M
CO-04	L	S	M	L	M	S	S	M	M	L	M	M	L
CO-05	M	L	S	M	L	M	L	S	L	M	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I DIGITAL IMAGE FUNDAMENTALS 9

Elements of digital image processing systems, Elements of visual perception, brightness, contrast, hue, saturation, Color image fundamentals-RGB, HSI models, Image sampling, Quantization, Two-dimensional mathematical preliminaries, 2D transforms-DFT, DCT.

UNIT-II IMAGE ENHANCEMENT 9

Histogram equalization and specification techniques, Noise distributions, Spatial averaging, Directional Smoothing, Median, Geometric mean, Harmonic mean, Contra harmonic mean filters, Homo morphic filtering, Color image enhancement.

UNIT-III IMAGE RESTORATION 9

Image Restoration - degradation model, unconstrained restoration - Lagrange multiplier and constrained restoration, Inverse filtering-removal of blur caused by uniform linear motion, Wiener filtering, Geometric transformations-spatial transformations.

UNIT-IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform - Thresholding - Region based segmentation - Region growing - Region splitting and merging - Segmentation by morphological watersheds basic concepts - Dam construction - Watershed segmentation algorithm.

UNIT-VI MAGE COMPRESSION 9

Need for data compression, Huffman coding, Run Length Encoding, Shift codes, Arithmetic coding, Vector Quantization, Transform coding, JPEG standard, MPEG.

TOTAL: 45 HOURS

REFERENCES:

1. Rafael C. Gonzalez, Richard E. Woods, , Digital Image Processing', Pearson ,SecondEdition, 2004.
2. Anil K. Jain, Fundamentals of Digital Image Processing', Pearson 2002.
3. Kenneth R Castleman, Digital Image Processing Pearson Education 2007.
4. Rafael C. Gonzalez, Richard E. Woods, Steven Eddins,' Digital Image Processing usingMATLAB', Pearson Education, Inc., 2004.

CA35A7	SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Software Quality,
- To learn Test Case Design
- To learn Levels of Testing
- To learn Test Management
- To learn Controlling and monitoring.

Course Outcome		Cognitive Skill
CO-01	Understand the concepts of software Testing.	R, U, E
CO-02	Use white box and black box testing using demo projects.	U, E, An
CO-03	Evaluate Software on the basis of integration and acceptance test suites, along with regression tests.	An, A
CO-04	Understand the different types of testing in software industry.	An, S
CO-05	Perform the test automations using advanced tools and technologies.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	S	S	M	S	S	M	S	S	M	S
CO-02	L	L	M	M	L	M	L	L	M	M	L	M	L
CO-03	L	L	M	M	L	M	L	L	M	M	L	M	L
CO-04	S	S	M	S	S	M	S	S	M	S	S	M	S
CO-05	L	L	S	M	L	S	L	L	S	M	L	S	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Testing process- Terminologies in testing- limitations of testing - boundary value analysis Robustness testing - worst case testing - robust worst case testing - equivalence class testing creation of equivalence classes- decision table based testing - parts of decision table - limited entry and extended entry decision tables - dont care conditions and rule count

UNIT-II WHITE BOX AND BLACKBOX TESTING 9

Introduction to white box testing-static testing-structural testing-challenges in white box testing - black box testing introduction - why black box testing-requirement based testing- positive and negative testing - boundary value analysis -decision tables-equivalence partitioning state based or graph based testing - compatibility testing - user documentation testing - domain testing.

UNIT-III INTEGRATION, SYATEM AND ACCEPATANCE TESTING 9

Integration testing introduction - types and phases of integration testing - defect bash elimination - system testing introduction - functional testing - non functional testing - acceptance testing.

UNIT-IV PERFORMANCE AND REGRESSION TESTING 9

Introduction - factors governing performance testing - methodology for performance testing tools and process for performance testing - introduction to regression testing - types of regression testing - when to do and how to do regression testing.

UNIT-V TEST AUTOMATION AND METRICS 9

Test automation introduction - scope - design and architecture for automation - process model for automation - selecting test tool - challenges in automation - what are metrics - types of metrics project metrics - progress and productivity metrics.

TOTAL: 45 HOURS

REFERENCES:

1. Yogesh Singh,” Software Testing”, Replica Press PVT Ltd, 2013. (Unit I)
2. SrinivaseanDesikan and Gopalaswamy Ramesh, ”Software Testing - Principles andPractices”, Pearson Education 2006. (Units II, III, IV, V)
3. Yogesh Singh, Software Testing Paperback , Cambridge University Press 2013
4. M.G Limaye, ”Software testing Principles, Techniques and Tools”, McGraw Hill Education,2017
5. ElfriedeDustin,”Effective Software Testing”, First Edition, Pearson Eduction 2004.
6. Gopalaswamy Ramesh and SrinivasanDesikan Software Testing: Principles andPractice Pearson Education 2006.

		L	T	P	C
CA35A8	**USER INTERFACE DESIGN**	**3**	**0**	**0**	**3**

OBJECTIVES:

- To study concepts of various user interfaces
- To understand soft computing techniques
- To understand of menus, windows, interfaces and business functions.
- To study characteristics, components and various controls for windows.
- To study the concepts to understand about various problems in windows design with color, text, and graphics.

Course Outcome		Cognitive Skill
CO-01	Describe the characteristics of graphics interface and its possible.	R, U, E
CO-02	Design the standards and structures.	U, E, An
CO-03	Explain the components of web systems and text boxes.	An, A
CO-04	Demonstrate the guidance of multimedia and textboxes.	An, S
CO-05	Apply the prototype and kinds of tests	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO-L	PO-M
CO-01	S	S	M	S	S	S	M	S	S	M	S	S	S
CO-02	L	L	M	M	L	L	M	M	L	M	M	L	L
CO-03	L	L	M	M	L	L	M	M	L	M	M	L	L
CO-04	S	S	M	S	S	S	M	S	S	M	S	S	S
CO-05	L	L	S	M	L	L	S	M	L	S	M	L	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Introduction - Importance - Human computer interface - Characteristics of GUI - Direct manipulation graphical system - Web user interface - Popularity - Characteristics and Principles.

UNIT-II DESIGN PROCESS 9

User interface design process - Obstacles - Usability - Human characteristics in design - Human interaction speed - Business functions - Requirements analysis - Direct - Indirect methods - Basic business functions - Design standards - System Timings - Human consideration in screen design - Structures of menus - Functions of menus - Contents of menu - Formatting - Phrasing the menu - Selecting menu choice - Navigating menus - Graphical Menus.

UNIT-III PRESENTATION STYLES 9

Windows: Characteristics - Components - Presentation styles - types - Managements Organizations - Operations - Web systems- device- based controls: Characteristics - Screen-based controls: Operate control - Text boxes - Selection control - Combination control - Custom control - Presentation control.

UNIT-IV WEB PAGES DESIGN 9

Text for web pages - Effective feedback - Guidance and assistance - Internationalization Accessibility - Icons - Image - Multimedia - Coloring.

UNIT-V WINDOWS LAYOUTS 9

Windows layout-test: Prototypes - Kinds of tests - Retest - Information search - Visualization Hypermedia - WWW -Software tools.

TOTAL: 45 HOURS

REFERENCES:

1. Wilbent. O. Galitz ,"The Essential Guide To User Interface Design", John Wiley and Sons, Third edition 2018.
2. Ben Sheiderman, "Design The User Interface", Pearson Education, Sixth Edition 2015.
3. Alan Cooper, "The Essential Of User Interface Design", Wiley Dream Tech Ltd.,2002.

CA35A9	SERVICE ORIENTED ARCHITECTURE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain understanding of the basic principles of service orientation.
- To learn service-oriented analysis techniques.
- To learn technology underlying the service design.
- To learn advanced concepts such as service composition, orchestration and Choreography.
- To know about various WS specification standards.

Course Outcome		Cognitive Skill
CO-01	Understand the primary concepts of SOA.	R, U, E
CO-02	Understand XML technologies, service orientation and benefits of SOA	U, E, An
CO-03	Understand web services and WS standards	An, A
CO-04	Use web services extensions to develop solutions	An, S
CO-05	Understand and apply service modelling, service-oriented analysis and design for application development	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	S	S	M	S	S	S	M	S	S	S
CO-02	L	L	M	M	L	M	M	L	L	M	M	L	L
CO-03	L	L	M	M	L	M	M	L	L	M	M	L	L
CO-04	S	S	M	S	S	M	S	S	S	M	S	S	S
CO-05	L	L	S	M	L	S	M	L	L	S	M	L	L

S- Strong, M- Medium, L-Low, N- Not Relevant

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UNIT-I EVOLUTION AND SERVICE ORIENTATION 9

History of XML, Web Service and SOA-Evolution of SOA-Roots of SOA-Comparing SOA to client-server and distributed internet architectures-Anatomy of SOA-How components in an SOA interrelate-Principles of service orientation.

UNIT-II WEB SERVICE AND PRIMITIVE SOA 9

Web services-Service descriptions-Messaging with SOAP-Message exchange Patterns-Primitive MEPs-Service Activity-Coordination-Atomic Transactions-Business activities-Orchestration-Choreography-Collaboration.

UNIT-III BUILDING SOA 9

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-Task-centric business service design.

UNIT-IV SOA PLATFORM 9

SOA platform basics-SOA support inJ2EE-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-ASP.NET webservices-Web Services Enhancements (WSE).

UNIT-V SERVICE ORIENTED DESIGN 9

Introduction to WS-BPEL basics-WS-BPEL Elements, WS-Coordination, Service oriented business process design, WS-Addressing-WS-Reliable Messaging, WS-Metadata Exchange, WS-Policy, WS-Security, XML-Signature.

TOTAL: 45 HOURS

REFERENCES:

1. Thomas Erl,” Service-Oriented Architecture: Analysis and Design for webservices and microservices”,Pearson Education, 2016.
2. Newcomer, Lomow,” Understanding SOA with Web Services”, PearsonEducation,2005.
3. Sandeep Chatterjee, James Webber,” Developing Enterprise Web Services,AnArchitectsGuide”, Pearson Education, 2005.
4. Dan Woods and Thomas Mattern, ”Enterprise SOA Designing IT for Business Innovation”OREILLY, First Edition, 2006.

CA35B1	INFORMATION STORAGE MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic components of Storage System Environment.
- To understand the Storage Area Network Characteristics and Components.
- To examine emerging technologies including IP-SAN.
- To learn Networking Principles.
- To understand the local and remote replication technologies.

Course Outcome		Cognitive Skill
CO-01	Understand the logical and physical components of a Storage infrastructure.	R, U, E
CO-02	Evaluate storage architectures, including storage subsystems, DAS, SAN, NAS, and CAS.	U, E, An
CO-03	Understand the various forms and types of Storage Virtualization.	An, A
CO-04	Describe the different role in providing disaster recovery and business continuity capabilities.	An, S
CO-05	Monitor the storage infrastructure and management activities	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	S	M	S	S	S	S	S	M	S	S	S
CO-02	M	L	L	M	M	L	L	L	L	M	M	L	L
CO-03	M	L	L	M	M	L	L	L	L	M	M	L	L
CO-04	S	S	S	M	S	S	S	S	S	M	S	S	S
CO-05	M	L	L	S	M	L	L	L	L	S	M	L	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I STORAGE SYSTEMS 9

Introduction to evolution of storage architecture, key data center elements, virtualization and cloud computing, key data center elements - host (or compute), Sconnectivity, storage and application in both classic and virtual environments.RAID on application performance, Components of intelligent storage systems and virtual storage provisioning and intelligent storage system implementations.

UNIT-II STORAGE NETWORKING TECHNOLOGIES 9

Fibre Channel SAN components, connectivity options, and topologies including access protection mechanism "Zoning", FC protocol stack, addressing and operations, SAN-based virtualization and VSAN technology, ISCSI and FCIP protocols for storage access over IP network, Converged protocol FCOE and its components, Network Attached Storage(NAS) components, protocol and operations, File level storage virtualization, object based storage and unified storage platform.

UNIT-III BACKUP, ARCHIVE AND REPLICATION 9

Business continuity terminologies, planning and solutions, Clustering and multi pathing architecture to avoid single points of failure, Backup and recovery - methods, targets and topologies, Data reduplication and backup in virtualized environment, Fixed content and data archive, Local replication in classic and virtual environments, Remote replication in classic and virtual environments, Three - site remote replication and continuous data protection.

UNIT-IV CLOUD COMPUTING 9

Definition of cloud computing, Characteristics of cloud computing, steps involved in transitioning from classic data center to cloud computing environment services and deployment models, cloud infrastructure components, cloud migration considerations.

UNIT-V SECURING AND MANAGING STORAGE INFRASTRUCTURE 9

Security threats, and counter measures in various domains security solutions for FC-SAN, IP-SAN and NAS environments, Security in virtualized and cloud environments, Monitoring and managing various information infrastructure components in classic and virtual environments, information lifecycle management (ILM) and storage tiering, Cloud service management activities.

TOTAL: 45 HOURS

REFERENCES:

1. Information storage and Management: storing, Managing and Protecting Digital Information in Classic, Virtualized, and cloud Environments, 2nd Edition, EMC Education Services, Wiley ISBN:978-1-11780-9483-9
2. Networked Storage Concepts and protocols Techbook (Online Version)
3. Learning Aids on https://education.emc.com/ISMbikv2/default.aspx.
4. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, Osborne, 2011.

CA35B2	SYSTEM SOFTWARE INTERNALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the functions of system software
- Discuss the basic concepts and structure of computers.
- Introduce the concepts how virtual machines, hypervisors, virtual networks and virtual storage work together.
- To study the concepts of virtual machine and emulation.
- Able to study the architecture of a hypothetical machine, its assembly language, macro language.

Course Outcome		Cognitive Skill
CO-01	Understand the concepts of machine code and computer architectures.	R, U, E
CO-02	Analyse and synthesize the Loader and linker using demo programs.	U, E, An
CO-03	Macro processors may be evaluated on the basis of basic functions.	An, A
CO-04	Virtual machines and emulators shall be experimented and evaluated using available methods.	An, S
CO-05	Provides information about virtual machines, virtual networking, virtual storage, VM management and troubleshooting.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	S	M	S	S	S	S	S	M	S	S	S
CO-02	M	M	L	M	M	L	S	L	M	M	M	M	L
CO-03	M	M	L	M	M	L	S	L	L	M	M	L	L
CO-04	S	S	S	M	S	S	S	S	S	M	S	S	S
CO-05	M	L	L	S	M	L	L	L	L	S	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I REVIEW OF COMPUTER ARCHITECTURE 9

Machine Instructions and Programs- Machine Code- Interpretation of Machine codes Assemblers - Assembly languages - Instruction set -Basic Assembler Functions - Assembler Features - Assembler Design Options - Designing an Assembler.

UNIT-II LOADERS AND LINKERS 9

Basic Loader Functions - Machine-Dependent Loader Features - Machine-Independent Loader

Features - Loader Design Options - Architectural Issues- Object Files - Storage Allocation - Symbol Management - Libraries - Relocation -Loading and Overlays - Shared Libraries Dynamic Linking and Loading - Advanced Techniques

UNIT-III MACROPROCESSORS 9

Basic Macro Processor Functions - Machine-Independent Macro Processor Features - Macro Processor Design Options - Basic Compiler Functions - Grammars - Lexical Analysis - Syntactic Analysis - Code Generation.

UNIT-IV INTRODUCTION TO VIRTUAL MACHINES 9

Pascal P-Code VM- Functions - Applications - Object-Oriented VMs - Functions - Applications - Java VM Architecture- Functions - Applications - Common Language Infrastructure - Dynamic Class Loading - Security - Garbage Collection - Optimization

UNIT-V EMULATION 9

. Binary Coding - Interpretation and Binary Translation - Instruction Set Issues - Process Virtual Machines- Introduction - Profilin - Migration - Grids- Applications of Process Virtual Machines - Examples of real-world implementations of system software.

TOTAL: 45 HOURS

REFERENCES:

1 W. Stallings: "Operating Systems: Internals and Design Principles", 7/E, Pearson Pub., 2014.
2 Silberschatz, Galvin and Gagne: "Operating System Concepts", 8/E, John Wiley & Sons, 2014.
3 Leland L. Beck, ”System Software”, 3rd ed., Pearson Education, 2003.
4 John R. Levine, ”Linkers Loaders”, Morgan Kauffman, 2003. (Unit 2)
5 James E Smith and Ravi Nair, ”Virtual Machines”, Elsevier, 2005. (Units 4, 5)
6 Alfred V Aho, Ravi Sethi, Jeffrey D Ullman, ”Compilers”, Pearson Education, 2007.
7 Robert W. Sebesta, ”Concepts of Programming Languages”, 7th ed., Pearson Education,2006.
8 Terrance W Pratt, Marvin V Zelkowitz, T V Gopal, ”Programming Languages”, 4thed.Pearson Education, 2006.
9 Carl Hamacher, ZvonkoVranesic, SafwatZaky, ”Computer Organization”, 5th ed.,McGraw Hill, 2002.
10. Silberschatz, Galvin, Gagne, ”Operating System Concepts”, 6th ed., Wiley, 2003.

CA35B3	BIO INFORMATICS	L	T	P	C
		3	0	0	3

OBJECTIVES :

- To learn the basic principles of bioinformatics and technologies
- To know the architecture of Dataware house and datamining techniques for bioinformatics sciences
- To learn the various modelsof biometrics as a tool for bioinformatics
- To know the pattern matching and visualization techniques for bioinformatics
- To learn the Microarray technology for bioinformatics

Course Outcome		Cognitive Skill
CO-01	Apply the knowledge and awareness of the basic principles and concepts of bioinformatics.	R, U, E
CO-02	Interpret relationships among data mining techniques and bioinformatics in Bioinformatics sapplications.	U, E, An
CO-03	To implement various models of tools for bioinformatics applications.	An, A
CO-04	To implement various pattern matching and visualization techniques for bioinformatics.	An, S
CO-05	Have problem-solving skills, including the ability to develop new algorithms and analysis methods.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	S	S	M	S	S	S	S	M	S	S	S
CO-02	L	M	M	L	M	M	L	L	L	M	M	L	L
CO-03	L	M	M	L	M	M	L	L	L	M	M	L	L
CO-04	S	M	S	S	M	S	S	S	S	M	S	S	S
CO-05	L	S	M	L	S	M	L	L	L	S	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Need for Bioinformatics technologies - Overview of Bioinformatics technologies Structural bioinformatics - Data format and processing - Secondary resources and applications - Role of Structural bioinformatics - Biological Data Integration System.

UNIT-IIDATAWAREHOUSING AND DATAMINING IN BIOINFORMATICS 9

Bioinformatics data - Data warehousing architecture - data quality - Biomedical data analysis

DNA data analysis - Protein data analysis - Machine learning - Neural network architecture and applications in bioinformatics

UNIT-III MODELING FOR BIOINFORMATICS 9

Hidden markovmodeling for biological data analysis - Sequence identification - Sequence classification - multiple alignment generation - Comparative modeling - Protein modelinggenomicmodeling - Probabilistic modeling - Bayesian networks - Boolean networks - Molecular modeling - Computer programs for molecular modeling.

UNIT-IV PATTERN MATCHING AND VISUALIZATION 9

Gene regulation - motif recognition - motif detection - strategies for motif detection -Visualization - Fractal analysis - DNA walk models - one dimension - two dimensionhigher dimension - Game representation of Biological sequences - DNA, Protein, Amino acid sequences.

UNIT-V MICROARRAY ANALYSIS 9

Microarray technology for genome expression study - image analysis for data extraction preprocessing - segmentation - gridding - spot extraction - normalization, filtering - cluster analysis - gene network analysis - Compared Evaluation of Scientific Data Management Systems - Cost Matrix - Evaluation model - Benchmark - Tradeoffs.

TOTAL: 45 HOURS

REFERENCES:

1. Yi-Ping Phoebe Chen (Ed), ”BioInformatics Technologies”, First Indian Reprint, SpringerVerlag, 2007.
2. Zoe lacroix and Terence Critchlow, ”BioInformatics - Managing Scientific data”, FirstIndian Reprint, Elsevier, 2004.
3. Bryan Bergeron, ”Bio Informatics Computing”, Second Edition, Pearson Education, 2003.

CA35B4	MANAGEMENT INFORMATION SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Information system Fundamentals
- To be familiar with representation of system architecture
- To learn technology underlying the architecture design
- To learn advanced concepts of Decision theory
- To know about development life cycle of Information system

Course Outcome		Cognitive Skill
CO-01	Recognize contemporary MIS theory and how the information systems support business strategy, business processes, and practical applications in an organization.	R, U, E
CO-02	Understand the leadership role of Management Information Systems in achieving business competitive advantage through informed decision making.	U, E, An
CO-03	Analyze and synthesize business information and systems to facilitate evaluation of strategic alternatives.	An, A
CO-04	Students can have effectively communicate strategic alternatives to facilitate decision making.	An, S
CO-05	Describe the role of information technology and information systems in business and also record the current issues of information technology and relate those issues to the firm.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	S	S	M	S	S	S	S	M	S	S	S
CO-02	L	M	M	L	M	M	L	L	L	M	M	L	L
CO-03	L	M	M	L	M	M	L	L	L	M	M	L	L
CO-04	S	M	S	S	M	S	S	S	S	M	S	S	S
CO-05	L	S	M	L	S	M	L	L	L	S	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INFORMATION SYSTEM AND ORGANIZATION 9

Matching the Information System Plan to the Organizational Strategic Plan - Identifying Key Organizational Objective and Processes and Developing an Information System Development - User role in Systems Development Process - Maintainability and Recoverability In system design.

UNIT-II REPRESENTATION AND ANALYSIS OF SYSTEM STRUCTURE 9

Models for Representing Systems: Mathematical, Graphical and Hierarchical (Organization Chart, Tree Diagram) - Information Flow - Process Flow - Methods and Heuristics - Decomposition and Aggregation - Information Architecture - Application of System Representation to Case Studies.

UNIT-III SYSTEMS, INFORMATION AND DECISION THEORY 9

Information Theory - Information Content and Redundancy - Classification and Compression - Summarizing and Filtering - Inferences and Uncertainty - Identifying Information needed to Support Decision Making - Human Factors - Problem characteristics and Information System Capabilities in Decision Making.

UNIT-IV INFORMATION SYSTEM APPLICATION 9

Transaction Processing Applications - Basic Accounting Application - Applications for Budgeting and Planning - Other use of Information Technology: Automation - Word Processing - Electronic Mail - Evaluation Remote Conferencing and Graphics - System and Selection - Cost Benefit - Centralized versus Decentralized Allocation Mechanism.

UNIT-V DEVELOPMENT AND MAINTENANCE OF INFORMATION SYSTEMS 9

Systems analysis and design - System development life cycle - Limitation - End User Development - Managing End Users - off- the shelf software packages - Outsourcing Comparison of different methodologies.

TOTAL: 45 HOURS

REFERENCES:

1. Laudon K.C, Laudon J.P, Brabston M.E, "Management Information Systems - Managingthe digital firm", Pearon Education, 2004.
2. Turban E.F, Potter R.E, "Introduction to Information Technology"; Wiley, 2004.
3. Jeffrey A.Hoffer, Joey F.George, Joseph S. Valachich, "Modern Systems Analysis and Design", Third Edition, Prentice Hall, 2002.

CA35B5	SOFTWARE RISK MANAGEMENT AND MAINTENANCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To gain expertise in discovering risk and usage of risk assessment tools
- To understand the risk plan , implementation and tracking risks
- To learn Risk Management at Different Levels
- To realize the software maintenance process, measurement and benchmarking
- To expertise in the SQA maintenance tools

Course Outcome		Cognitive Skill
CO-01	Understand the concepts of risk assessment and management.	R, U, E
CO-02	Implement Risk evaluation methods using recent tools and technologies.	U, E, An
CO-03	Formulate the project activity plan and project risk management	An, A
CO-04	Organize and manage Software Maintenance	An, S
CO-05	Apply the Risk maintenance activities for demonstrative projects.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	S	S	M	S	S	S	M	S	S	M	S
CO-02	L	M	M	L	M	M	L	L	M	M	L	M	M
CO-03	L	M	M	L	M	M	L	L	M	M	L	M	M
CO-04	S	M	S	S	M	S	S	S	M	S	S	M	S
CO-05	L	S	M	L	S	M	L	L	S	M	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I RISK CULTURE AND MANAGEMENT PROCESS 9

Risk- Basic Terms- Risk Vocabulary - Risk- Driven Project Management- Controlling the Process, Environment and Risk- Maturity in Risk Culture - Risk Scale - Preparing for Risk Risk Management- Paradigms- Five Models of Risk Management - Thinking about Less Risky alternatives - Risk Management at Different Levels - Risk Escalation - Risk Models- Risk Intelligence - Software Risk Management steps.

UNIT-II DISCOVERING RISK AND ASSESSMENT 9

Identifying software risk- Classification of Risks - Risk Taxonomy - Risk Mapping - Statements Risk Reviews - Risk Ownership and stakeholder management - Risk Assessment Approach - Risk Assessment tools and techniques - Risk Probability, impact, exposure, matrix and Application Problem- Self- assessment checklist.

UNIT-III RESPONDING TO RISKS AND TRACKING 9

Special Treatment for Catastrophic risks- Constraint Risks - Risk Mitigation Plan Case Study - Contingency Plans- Implementing Risk Response- Tracking Risk Response and Hazards Trigger Levels- Tracking Project Risks and Operational Risks- Learning by Tracking and Risk Tracker Tool.

UNIT-IV MAINTENANCE PROCESS 9

Software Maintenance- Customers Viewpoint- Economics of Maintenance- Issues in Maintenance- Software Maintenance Standard, Process, Activities and Categories - Maintenance Measurement - Service Measurement and Benchmarking - Problem Resolution- Reporting - Fix Distribution.

UNIT-V ACTIVITIES FOR MAINTENANCE 9

Role of SQA for Support and Maintenance - SQA tools for Maintenance- Configuration Management and Maintenance - Maintenance of Mission Critical Systems - Global Maintenance Teams - Foundation of S3m Process Model- Exemplary Practices.

TOTAL: 45 HOURS

REFERENCES:

1. C. RavindranathPandian, ”Applied Software Risk Management: A guide for Software Project Managers”, Auerbach Publications, 2007.
2. John Mcmanus, ”Risk Management in Software Development Projects”, Elsevier Butterworth Heinemann, 2016.
3. Alian April and Alain Abran, ”Software Maintenance Management Evaluation and

Continuous Improvement”, John Wiley Sons Inc, 2008.
4. Gopalaswamy Ramesh and Ramesh Bhattiprolu, ”Software Maintenance Effective Practices for Geographically Distributed Environments”, Second Reprint, Tata McGraw Hill, 2009.

CA35B6	WIRELESS NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the concept about Wireless networks, protocol stack and standards
- To understand and analyse the network layer solutions for Wireless networks
- To study about fundamentals of 3G Services, its protocols and applications
- To have in depth knowledge on internetworking of WLAN and WWAN
- To learn about evolution of 4G Networks, its architecture and applications

Course Outcome		Cognitive Skill
CO-01	Conversant with the latest 3G/4G networks and its architecture	R, U, E
CO-02	Design and implement wireless network environment for any application using latest wireless protocols and standards	U, E, An
CO-03	Ability to select the suitable network depending on the availability and requirement	An, A
CO-04	Get a detailed knowledge on internetworking of WLAN and WWAN	An, S
CO-05	Implement different type of applications for smart phones and mobile devices with latest network strategies	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	M	S	S	M	S	S	S	M	S	S	M	S
CO-02	L	M	M	L	M	M	L	L	M	M	L	M	M
CO-03	L	M	M	L	M	M	L	L	M	M	L	M	M
CO-04	S	M	S	S	M	S	S	S	M	S	S	M	S
CO-05	L	S	M	L	S	M	L	L	S	M	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I WIRELESS LOCAL AREA NETWORKS 9

Introduction to wireless LANs-IEEE 802.11 WLANs-Architecture-Protocol Stack-Physical Layer-MAC sublayer-MACManagement-HIPERLAN-System Architecture-Protocol Stack-HIPERLAN-2, Wi-Max.

UNIT-II 3G OVERVIEW AND 2.5G EVOLUTION 9

Migration path to UMTS, UMTS Basics, Air Interface, 3GPP Network Architecture,CDMA2000 overview-Radio and Network components, Network structure, Radio network,TD-CDMA, TD-SCDMA.

UNIT-III ADHOC AND SENSOR NETWORKS 9

Characteristics of MANETs-Introduction-Routing protocols-Table-driven and Source-initiated On Demand routing protocols, Hybrid protocols, Wireless Sensor networks-Sensor deployment-Network charecteristics-Design issues-Multipath routing-Data aggregation.

UNIT-IV WLAN 9

Interworking objectives and requirements, Schemes to connect WLANs and 3G Networks, Session Mobility, Interworking Architectures for WLAN and GPRS, System Description, Local Multipoint Distribution Service, Multichannel Multipoint Distribution system.

UNIT-V 4G AND BEYOND 9

4G Features and Challenges, Technology path, IMS Architecture, Convergent Devices, 4G Technologies and Handovers.Advanced Broadband Wireless Access- Advanced wireless Services, Multimedia (mobile TV), MVNO.

TOTAL: 45 HOURS

REFERENCES:

1. Clint Smith. P.E., and Daniel Collins, ”3G Wireless Networks”, 2nd Edition, Tata McGraw Hill, 2007. (Unit-II and Unit-V)
2. ItiSahaMisra, “Wireless Communications and Networks”,2nd Edition, Tata McGraw Hill,2013.
3. Vijay. K. Garg, ”Wireless Communication and Networking”, Morgan Kaufmann Publishers, m http://books.elsevier.com/9780123735805:, 2007.
4. Dharma PrakashAgrawal Qing-An Zeng, ”Introduction to Wireless and Mobile Systems”,Thomson India Edition, 2nd Ed., 2007. (Unit-III)
5. SumitKasera and NishitNarang, ” 3G Networks-Architecture, Protocols and Procedures”,Tata McGraw Hill, 2007

CA35B7	VIRTUALIZATION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Fundamentals of virtualization
- To understand memory management in virtualization
- To Study the fundamentals of I/O virtualization
- To study about virtualized computing
- To understand Virtualization security

Course Outcome		Cognitive Skill
CO-01	Deploy legacy OSs on virtual machines	R, U, E
CO-02	Understand the intricacies of server, storage, network, desktop and application virtualizations	U, E, An
CO-03	Design new models for virtualization	An, A
CO-04	Design and develop cloud applications on virtual machine platforms	An, S
CO-05	Design new models for Big data processing in cloud	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	S	S	M	S	S	S	S	S	S	M	S
CO-02	L	S	M	L	M	M	L	L	M	M	L	M	M
CO-03	L	M	M	L	S	M	M	L	S	M	L	M	M
CO-04	S	S	S	S	M	S	S	S	M	S	S	M	S
CO-05	L	S	M	L	S	M	L	L	S	M	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Overview: Why server virtualization -History and re-emergence -General structures. Architectures comparison. Commercial solutions -VMware, Xen. Virtual machines: CPU virtualization - Privileged instructions handling -Hypervisor - Para virtualization. Hardware-assisted virtualization.Booting up.Time keeping.CPU scheduling.Commercial examples.

UNIT-II MEMORY MANAGEMENT 9

Memory management in virtualization: partitioning -reclamation -ballooning. Memory sharing. OS-level virtualization -VM Ware memory management techniques -Red Hat Enterprise Virtualization.

UNIT-III VIRTUALIZING I/O DEVICES 9

I/O virtualization: Virtualizing I/O devices -monolithic model -virtual I/O server. Virtual networking -tunnelling -overlay networks. Commercial examples. Virtual storage: Granularity - file system level -blocks level.

UNIT-IV VIRTUALIZED COMPUTING 9

Virtualized computing: Virtual machine based distributed computing, elastic cloud computing, clustering, cold and hot migration. Emerging Applications.Commercial examples.Challenges and future trends.Case study - Real Machines.

UNIT-V VIRTUALIZATION SECURITY 9

Virtual Security: Virtualization security overview - Guest OS isolation, Guest OS monitoring, Image and snapshot management; Security recommendations - Hypervisor security, Guest OS security, Virtualized infrastructure security, desktop virtualization security; Secure virtualization planning and deployment.

TOTAL: 45 HOURS

REFERENCES:

1. Virtual Machines: Versatile Platforms for Systems and Processes (1st Ed): Jim Smith, RaviNair; Morgan Kaufmann (2005)
2. Matthew Portnoy, “Virtualization Essentials”, 2nd Edition, Wiley Publications, 2012.
3. Applied Virtualization Technology Usage models for IT professionals and SoftwareDevelopers (1st Ed): Sean Campbell Intel Press (2006).
4. Guide to Security for Full Virtualization Technologies (Recommendations of the National Institute of Standards and Technology-US), Karen Scarfone, MurugiahSouppaya Paul Hoffman, NIST Special Publication (2010).

CA35B8	BIG DATA ANALYTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the fundamental concepts of big data analytics
- To learn to analyze the big data using intelligent techniques.
- To understand the various search methods and visualization techniques.
- To learn to use various techniques for mining data stream.
- To understand the applications using Map Reduce Concepts.

Course Outcome		Cognitive Skill
CO-01	To explore the fundamental concepts of big data analytics	R,U
CO-02	To learn to analyze the big data using intelligent techniques.	U,R,A
CO-03	To understand the various search methods and visualization techniques.	U,A
CO-04	To learn to use various techniques for mining data stream.	U, An, E
CO-05	To understand the applications using Map Reduce Concepts.	U, An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	M	M	S	S	S	S	M	S	S	N
CO-02	S	S	S	M	M	S	S	S	S	M	S	S	M
CO-03	S	M	S	M	M	S	S	S	S	S	S	S	M
CO-04	S	S	S	M	M	M	S	S	S	M	S	S	M
CO-05	S	S	S	S	M	S	S	S	S	M	M	S	L

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I INTRODUCTION 9

Introduction to data analysis - Challenges of Conventional Systems - Nature of Data - Modern Data Analytic Tools - Statistical Concepts: Sampling and sampling Distributions - Re-Sampling Statistical Inference - Prediction and prediction error- Introduction to big data- characteristics of big data - history of big data- use cases of big data applications.

UNIT-II MINING DATA STREAMS 9

Introduction To Streams Concepts - Stream Data Model- data stream management system Stream Queries - Sampling Data in a Stream - Filtering Streams– Counting Distinct Elements in a Stream - Estimating Moments-Counting Ones in a Window - Decaying Windows

UNIT-III HADOOP 9

History of Hadoop- The Hadoop Distributed File System - Components of Hadoop- Analyzing the Data with Hadoop- Scaling Out- Hadoop Streaming- Design of HDFS-Interfaces Developing a Map Reduce Application-How Map Reduce Works-Anatomy of a Map Reduce Job run-Failures-Job Scheduling-Shuffle and Sort - Task execution

UNIT-IV HADOOP ENVIRONMENT 9

Setting up a Hadoop Cluster - Cluster specification - Cluster Setup and Installation -Hadoop Configuration-Security in Hadoop - Administering Hadoop - HDFS – Monitoring Maintenance - Hadoop benchmarks- Hadoop in the cloud.

UNIT-V HADOOP FRAMEWORKS 9

Introduction to Pig- comparison with databases- functions-user defined functions - Data processing operators in Pig- Introduction to Hive- Hive shell -Hive services - HiveQL - User defined functions - Querying Data in Hive - fundamentals of HBase - Hbase VS RDBMS Introduction to Zoo Keeper – Zoo Keeper services.

TOTAL: 45 HOURS

REFERENCES:

1. Michael Berthold, David J. Hand, ”Intelligent Data Analysis”, Springer, 2007.
2. Tom White ”Hadoop: The Definitive Guide” Third Edition, Oreilly Media, 2012.
3. AnandRajaraman and Jeffrey David Ullman, ”Mining of Massive Datasets”, Cambridge University Press, 2012.
4. Glenn J. Myatt, ”Making Sense of Data”, John Wiley Sons, 2007
5. Chris Eaton, Dirk DeRoos, Tom Deutsch, George Lapis, Paul Zikopoulos, ”UnderstandingBig Data: Analytics for Enterprise Class Hadoop and Streaming Data”, McGrawHill Publishing, 2012

EVEN SEMESTER ELECTIVES

CA35B9	AD-HOC NETWORKS	L	T	P	C
		3	0	4	3

OBJECTIVES

- Learn the fundamentals of wireless communication technology.
- Be exposed to designing a MAC protocols.
- Learn the mechanisms of ad-hoc networks.
- Be familiar with ad-hoc routing protocols.
- Learn to design multicasting routing protocols and analyze security features.

Course Outcome		Cognitive Skill
CO-01	Understand the fundamentals of wireless communication technology and study the characteristics of the Wireless Channel	U, R
CO-02	The MANETs concepts and architecture and Analyze the design Challenges.	R, An
CO-03	Analyze the issues in designing a MAC Protocol and Classification of MAC	S , An
CO-04	Evaluate Contention based protocols with Scheduling Mechanisms and Multi-channelMAC design.	E, A
CO-05	Understand the mechanisms of ad-hoc networks and classifications of Routing Protocols.	R, An
CO-06	Evaluate Cluster Switch Gateway Routing and Dynamic Source Routing (DSR).	E
CO-07	Analyze the issues in Designing a Multicast Routing Protocol	S, An
CO-08	Create Routing Protocol and Energy–Efficient Multicasting.	A
CO-09	Evaluate the Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks	E
CO-10	Create and design multicasting routing protocols and analyze security features.	R

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	L	L	M	M	S	M	M	M	S	L	M	L	M
CO-02	L	S	M	L	S	M	M	M	S	L	M	L	M
CO-03	S	M	M	L	M	S	M	M	M	M	M	M	S
CO-04	S	S	M	M	S	S	M	M	S	L	M	L	S
CO-05	L	S	M	L	S	S	M	M	S	L	M	M	M

CO-06	M	L	M	S	S	M	M	M	S	S	M	S	M
CO-07	L	L	S	S	S	M	M	M	S	L	M	L	M
CO-08	S	M	L	L	S	M	M	M	S	L	M	L	S
CO-09	L	S	M	L	S	M	M	M	S	L	M	L	S
CO-10	L	L	S	L	S	M	M	M	S	M	M	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTRODUCTION 9

Fundamentals of Wireless Communication Technology –The Electromagnetic Spectrum –Radio propagation Mechanisms –Characteristics of the Wireless Channel - Mobile ad hoc networks (MANETs):concepts and architectures - Applications of Ad Hoc networks - Design Challenges in Ad hoc Networks.

UNIT II: MAC PROTOCOLS FOR AD HOC WIRELESS NETWORKS 9

Issues in designing a MAC Protocol-Classification of MAC Protocols-Contention based protocols-Contention based protocols with Reservation Mechanisms-Contention based protocols with Scheduling Mechanisms –Multi channel MAC-IEEE 802.11.

UNIT III: AD HOC ROUTING PROTOCOLS 9

Introduction – Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks – Classifications of Routing Protocols – Table–Driven Routing Protocols – Destination Sequenced Distance Vector (DSDV) – Wireless Routing Protocol (WRP) – Cluster Switch Gateway Routing (CSGR) – Source–Initiated On–Demand Approaches – Ad hoc On–Demand Distance Vector Routing (AODV) – Dynamic Source Routing (DSR).

UNIT IV: MULTICAST ROUTING IN ADHOC NETWORKS 9

Introduction – Issues in Designing a Multicast Routing Protocol – Operation of Multicast Routing Protocols – An Architecture Reference Model for Multicast Routing Protocols – Classifications of Multicast Routing Protocols – Tree–Based Multicast Routing Protocols–Mesh–Based Multicast Routing Protocols - Energy–Efficient Multicasting.

UNIT V: TRANSPORT LAYER– SECURITY PROTOCOLS 9

Introduction – Issues in Designing a Transport Layer Protocol for Ad hoc Wireless Networks – Design Goals of a Transport Layer Protocol for Ad hoc Wireless Networks –Classification of Transport Layer Solutions – TCP over Ad hoc Wireless Networks – Other Transport Layer Protocols for Ad hoc Wireless Networks – Security in Ad Hoc Wireless Networks – Network Security Requirements.

TOTAL: 45 HOURS

REFERENCES

1. C. Siva Ram Murthy and B. S. Manoj, “Ad Hoc Wireless Networks Architectures and Protocols”, Prentice Hall, PTR, 2004.
2. C. K. Toh, “Ad Hoc Mobile Wireless Networks Protocols and Systems”, Prentice Hall, PTR, 2001.
3. Charles E. Perkins, “Ad Hoc Networking”, Addison Wesley, 2000.
4.

		L	T	P	C

CA35C1	MACHINE LEARNING TECHNIQUES	3	0	0	3

OBJECTIVES

- Explain theory underlying machine learning.
- Construct algorithms to learn linear and non-linear models.
- Implement data clustering algorithms and to learn tree and rule-based models.
- Apply reinforcement learning techniques for real life problems.

Course Outcome		Cognitive Skill
CO-01	Explain theory underlying machine learning.	R
CO-02	Construct algorithms to learn linear and non-linear model.	E
CO-03	Implement data clustering algorithms and to learn tree and rule-based models.	An
CO-04	Apply reinforcement learning techniques for real life problems.	A
CO-05	Learn various aspects of data Sciences.	U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO –L	PO-M
CO-01	S	M	M	S	S	S	S	M	S	M	S	M	S
CO-02	S	M	S	M	S	M	S	M	S	M	S	M	S
CO-03	M	S	S	S	S	S	S	M	M	M	S	S	M
CO-04	M	S	S	S	S	S	S	S	M	M	M	S	M
CO-05	S	M	M	S	M	M	S	M	S	M	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : FOUNDATIONS OF LEARNING 9

Components of learning – learning models – geometric models – probabilistic models – logic models – grouping and grading – learning versus design – types of learning – supervised – unsupervised – reinforcement – theory of learning – feasibility of learning – error and noise – training versus testing – theory of generalization – generalization bound – approximation-generalization tradeoff – bias and variance – learning curve.

UNIT II: LINEAR MODELS 9

Linear classification – univariate linear regression – multivariate linear regression – – regularized regression – Logistic regression – perceptrons – multilayer neural networkslearning neural networks structures – support vector machines – soft margin SVM – going beyond linearity – generalization and overfitting – regularization – validation.

UNIT III : DISTANCE-BASED MODELS **9**

Nearest neighbor models – K-means – clustering around medoids – silhouttes – hierarchical clustering – k-d trees – locality sensitive hashing– non-parametric regression – ensemble learning – bagging and random forests – boosting – meta learning.

UNIT IV : TREE AND RULE MODELS **9**

Decision trees – learning decision trees – ranking and probability estimation trees – regression trees – clustering trees – learning ordered rule lists – learning unordered rule lists – descriptive rule learning – association rule mining – first-order rule learning.

UNIT V : REINFORCEMENT LEARNING **9**

Passive reinforcement learning – direct utility estimation – adaptive dynamic programming – temporal difference learning – active reinforcement learning – exploration – learning an action-utility function – Generalization in reinforcement learning – policy search – applications in game playing – applications in robot control.

TOTAL: 45 HOURS

REFERENCES:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, ―Learning from Data, AML Book Publishers, 2012.
2. P. Flach, ―Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press, 2012.
3. K. P. Murphy, ―Machine Learning: A probabilistic perspective, MIT Press, 2012.
4. M. Mohri, A. Rostamizadeh, and A. Talwalkar, ―Foundations of Machine Learning, MIT Press, 2012.
5. C. M. Bishop, ―Pattern Recognition and Machine Learning, Springer, 2007.
6. D. Barber, ―Bayesian Reasoning and Machine Learning, Cambridge University Press, 2012.

		L	T	P	C
CA35C2	**MULTIMEDIA DATABASES**	**3**	**0**	**0**	**3**

OBJECTIVES

- To learn the basics concepts in Database Management systems.
- To understand multidimensional data structures.
- To learn Text/Document databases.
- To study Audio databases.
- To study design and architecture of Multimedia databases.

Course Outcome		Cognitive Skill
CO-01	To learn the basics concepts in Database Management systems.	R
CO-02	To understand multidimensional data structures.	U
CO-03	To learn Text/Document databases.	R
CO-04	To study Audio databases.	An
CO-05	To study design and architecture of Multimedia databases.	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO-I	PO-J	PO-k	PO –L	PO-M
CO-01	S	M	M	S	S	S	S	M	S	M	S	M	S
CO-02	S	M	S	M	S	M	S	M	S	M	S	M	S
CO-03	M	S	S	S	S	S	S	M	M	M	S	S	M
CO-04	M	S	S	S	S	S	S	S	M	M	M	S	M
CO-05	S	M	M	S	M	M	S	M	S	M	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: BASICS OF DATABASE MANAGEMENT SYSTEMS 9

Relational Model – SQL, Functional Dependencies - Normal Forms – Multivalued Dependencies, Join Dependencies – Examples - An introduction to Object-oriented Databases.

UNIT II: MULTIDIMENSIONAL DATA STRUCTURES 9

Multidimensional Data Structures: k-d Trees - Point Quadtrees - The MX-Quadtree – Rtrees - comparison of Different Data Structures.

UNIT III: TEXT/DOCUMENT DATABASES 9

Precision and Recall - Stop Lists - Word Stems and Frequency Tables - Latent Semantic Indexing - TV-Trees - Other Retrieval Techniques Image Databases - Raw Images - Compressed Image Representations - Similarity-Based Retrieval - Alternative Image DB Paradigms - Representing Image DBs with Relations - Representing Image DBs withR-Trees - Retrieving Images By Spatial Layout- Implementations.

UNIT IV: AUDIO DATABASES 9

A General Model of Audio Data - Capturing Audio Content through DiscreteTransformation - Indexing Audio Data.Video Databases - Organizing Content of a Single Video
- Querying Content of Video Libraries - Video Segmentation

UNIT V: DESIGN AND ARCHITECTURE OF A MULTIMEDIA DATABASE 9

-Organizing Multimedia Data Based on ThePrinciple of Uniformity - Media Abstractions -

Query Languages for Retrieving Multimedia Data.

TOTAL: 45 HOURS

REFERENCES:

1. V. S. Subramanian, “Principles of Multimedia Database Systems”, Elsevier Publishers, 1998.
2. Elmasri and Navathe Fundamentals of Database Systems, 4th Edition, Addison Wesley, 2003.
3. S. Subramanian, “Principles of Multimedia Database Systems”, Elsevier, 1998. C. J. Date, “An Introduction to Database Systems”, Seventh Edition, Pearson Education, 2000.
4. S. Khoshafian and A. B. Bakor, “Multimedia and Imaging Databases”, Elsevier,1996.
5. Kingsley C. Nwosu, “Multimedia Database Systems: Design and Implementation Strategies”, Kluwer Academic Publishers, 1996.
6. Prabhakaran, “Multimedia Database Management Systems”,Springer,1st Edition, 1996.
7. Lynne Dunckley, “Multimedia Databases: An Object-Relational Approach”, Pearson Education, 2003.

		L	T	P	C
CA35C3	**ARTIFICIAL INTELLIGENCE TECHNIQUES**	**3**	**0**	**0**	**3**

OBJECTIVES

- To know the underlying structure behind intelligence mathematically.
- To know the logical implications in computational intelligence.
- To know the automated learning techniques.
- To study the techniques of knowledge representation.
- To explore artificial intelligence techniques in real – time scenarios.

Course Outcome		**Cognitive Skill**
CO-01	Understand the search techniques	R
CO-02	Apply the search techniques to real-time problems	E
CO-03	Apply the reasoning techniques to real world problems	An
CO-04	Understand the representation of knowledge.	A
CO-05	Apply AI techniques in developing real world applications	U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	M	M	S	S	S	S	M	S	M	S	M	S
CO-02	S	M	S	M	S	M	S	M	S	M	S	M	S
CO-03	M	S	S	S	S	S	S	M	M	M	S	S	M
CO-04	M	S	S	S	S	S	S	S	M	M	M	S	M
CO-05	S	M	M	S	M	M	S	M	S	M	S	M	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: INTELLIGENT AGENTS AND KNOWLEDGE REPRESENTATION 9

Agents and Environments – Good Behavior: The Concepts of Rationality – The Nature of Environments – The Structure of Agents – Knowledge Representation – Object Oriented Approach – Semantic Nets – Frames – Semantic Web – Ontology.

UNIT II: SEARCH TECHNIQUES 9

Problem Solving by Search – Uninformed Search – Searching with Costs – Informed State Space Search – Heuristic Search – Problem Reduction Search – Game Search – Constraint Satisfaction Problems.

UNIT III : REASONING WITH LOWER ORDER LOGICS 9

Logical Agent – Proposition Logic – Syntax and Semantics – Theorem Proving – Model Checking – Inference in First Order Logic.

UNIT IV: ARTIFICIAL INTELLIGENCE PLANNING 9

Classical Planning – Partial Order Planning – Graph Plan and SAT Plan – Hierarchical Planning – Planning and Acting in Nondeterministic Domains – Multi Agent Planning.

UNIT V: LEARNING TECHNIQUES 9

Logical Formulation of Learning – Knowledge in Learning – Explanation-Based Learning – Learning using Relevance Information – Inductive Logic Programming – Statistical Learning – Learning with Complete Data – Learning with Hidden Data – Applications.

TOTAL: 45 HOURS

REFERENCES:

1. Stuart J. Russell, Peter Norvig, "Artificial Intelligence – A Modern Approach", Third Edition, Pearson Publishers, 2015.
2. Elaine Rich, Kevin Knight, Shivashankar B. Nair, "Artificial Intelligence", Third Edition, Tata McGraw-Hill Education, 2008.
3. Dheepak Khemani, "A first course in Artificial Intelligence", McGraw-Hill Education, 2013.
4. NPTEL, "Artificial Intelligence", http://nptel.ac.in/courses/106105079/2.
5. Sebastian Thrun, Peter Norvig, Udacity: "Introduction to Artificial Intelligence", https://in.udacity.com/course/intro–to–artificial–intelligence –cs271.

CA35C4	SOFTWARE REQUIREMENTS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the overview of requirement engineering
- To understand requirements elicitation
- To Study about requirements analysis
- To study about requirements development
- To study about requirements management

Course Outcome		Cognitive Skill
CO-01	To understand, analyze, interpret and review the software requirement overview.	R, U, An
CO-02	To recognize, design, analyze and implement the process of requirements elicitation and validation.	U, E
CO-03	To get expertise in identification of functional, non-functional requirements and human requirements baseline.	U, An, S
CO-04	To analyze, review and criticize the implementation requirements development and prototyping.	An, A, S
CO-05	Able to explore solutions for requirements validation andcase tools for requirements engineering.	A, S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	M	M	M	M	M	L	M	S	S	L	L	M	S
CO-02	S	S	L	M	S	L	M	M	M	M	L	L	M
CO-03	M	M	S	L	M	M	M	S	L	M	S	S	M
CO-04	S	M	S	M	M	M	M	S	S	L	L	L	M
CO-05	S	M	L	L	S	L	M	M	S	S	L	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: REQUIREMENTS ENGINEERING OVERVIEW 9

Software Requirement Overview – Software Development Roles –Software Development Process Kernels – Commercial Life Cycle Model – Vision Development – Stakeholders Needs & Analysis.

UNIT II: REQUIREMENTS ELICITATION 9

The Process of Requirements Elicitation – Requirements Elicitation ProblemsProblems of Scope – Problems of Understanding – Problems of Volatility – Current Elicitation Techniques – Information Gathering – Requirements Expression and Analysis – Validation – An Elicitation Methodology Framework – A Requirements Elicitation Process Model –

Methodology over Method – Integration of Techniques –FactFinding – Requirements Gathering – Evaluation and Rationalization – Prioritization – Integration and Validation.

UNIT III : REQUIREMENTS ANALYSIS **9**

Identification of Functional and Non Functional Requirements – Identification of Performance Requirements – Identification of safety Requirements – Analysis – Feasibility and Internal Compatibility of System Requirements – Definition of Human Requirements Baseline.

UNIT IV: REQUIREMENTS DEVELOPMENT **9**

Requirements analysis – Requirements Documentation – Requirements Development Workflow – Fundamentals of Requirements Development – Requirements Attributes Guidelines Document – Supplementary Specification Document – Use Case Specification Document – Methods for Software Prototyping – Evolutionary prototyping – Throwaway prototyping.

UNIT V : REQUIREMENTS VALIDATION **9**

Validation objectives – Analysis of requirements validation – Activities – Properties – Requirement reviews – Requirements testing – Case tools for requirements engineering.

TOTAL: 45 HOURS

BOOKS FOR REFERENCES:

1. Ian Sommerville, Pete Sawyer, "Requirements Engineering: A Good Practice Guide", Sixth Edition, Pearson Education, 2004.
2. Dean Leffingwell , Don Widrig, "Managing Software Requirements A Use Case Approach", Second Addition, Addison Wesley , 2003.
3. Karl Eugene Wiegers, "Software Requirements", Word Power Publishers, 2000.
4. Ian Graham, "Requirements Engineering and Rapid Development", Addison Wesley, 1998.

		L	T	P	C
CA35C5	**CYBER FORENSICS**	**3**	**0**	**0**	**3**

OBJECTIVES

- Learn the security issues network layer and transport layer.
- Be exposed to security issues of the application layer.
- Learn computer forensics.
- Be familiar with forensics tools.
- Learn to analyze and validate forensics data.

Course Outcome		**Cognitive Skill**
CO-01	Able to identify some of the factors driving the need for network security	R
CO-02	Understand the most common type of cryptographic algorithms.	U
CO-03	Students will be able to digitally sign emails and files.	U, A

CO-04	Able to configure simple firewall architecture	A
CO-05	Ability to understand the types of identity theft.	U
CO-06	Learn the use of computer forensics tools used in data analysis.	A, An
CO-07	Learn the issues of data acquisition and data recovery.	An
CO-08	Students will be learning to analyze and validate forensics data.	U, An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	S	S	S	L	S	S	M	S	M	S	M	L
CO-02	S	S	M	S	M	S	S	S	S	S	S	M	L
CO-03	S	S	S	S	M	S	L	L	S	S	S	M	M
CO-04	S	S	S	S	M	S	M	M	S	S	S	S	M
CO-05	S	S	M	S	S	S	S	S	S	S	S	S	S
CO-06	S	S	S	S	S	S	M	M	S	S	L	S	S
CO-07	S	S	S	S	S	S	S	S	S	S	M	S	S
CO-08	S	S	S	S	S	S	S	S	S	S	S	S	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : NETWORK LAYER SECURITY &TRANSPORT LAYER SECURITY 9

IPSec Protocol – IP Authentication Header – IP ESP – Key Management Protocol for IPSec. Transport layer Security: SSL protocol, Cryptographic Computations – TLS Protocol.

UNIT II : E-MAIL SECURITY & FIREWALLS 9

PGP – S/MIME – Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls – Firewall designs – SET for E-Commerce Transactions.

UNIT III : INTRODUCTION TO COMPUTER FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Introduction to Identity Theft & Identity Fraud. Types of CF techniques – Incident and incident response methodology –Forensics Technology and Systems .

UNIT IV : EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Working with Windows and DOS Systems. Current Computer Forensics Tools: Software/ Hardware Tools.

UNIT V : ANALYSIS AND VALIDATION **9**

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics.

TOTAL: 45 HOURS

REFERENCES:

1. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
2. Nelson, Phillips, Enfinger, Steuart, "Computer Forensics and Investigations", Cengage Learning, India Edition, 2008.
3. John R.Vacca, "Computer Forensics", Cengage Learning, 2005
4. Richard E.Smith, "Internet Cryptography", 3rd Edition Pearson Education, 2008.
5. Marjie T.Britz, "Computer Forensics and Cyber Crime": An Introduction", 3rd Edition, Prentice Hall, 2013.

CA35C6	**MOBILE COMMUNICATION TECHNIQUES**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

OBJECTIVES

- To study about Fundamental Concept of Wireless.
- To study about Mobile device Technologies

To study about Wireless networks**Course Outcome**		**Cognitive Skill**
CO-01	Understand the technologies used in wireless communication.	U
CO-02	To be familiar with protocols and its architecture in telecommunication system.	An
CO-03	To get a detailed idea on various wireless networking process and its deployments.	U
CO-04	To master the terminology and concepts of network layer.	A
CO-05	To be familiar with transport protocols and network security.	S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / **CO**	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO- I	PO-J	PO-k	PO-L	PO-M
CO-01	S	N	L	M	m	N	S	L	L	L	S	L	M
CO-02	M	S	S	M	M	M	M	s	M	L	S	S	M
CO-03	M	M	L	S	N	N	S	S	L	L	M	M	L
CO-04	L	L	M	M	S	L	S	L	S	L	M	S	L
CO-05	M	M	L	m	M	L	S	M	L	L	S	L	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : WIRELESS COMMUNICATION FUNDAMENTALS **9**

Introduction – Wireless transmission – Frequencies for radio transmission – Signals –Antennas – Signal Propagation – Multiplexing – Modulations – Spread spectrum – MAC - SDMA – FDMA – TDMA – CDMA – Cellular Wireless Networks.

UNIT II : TELECOMMUNICATION SYSTEMS **9**

GSM – System Architecture – Radio Interface – Protocols – Connection Establishment – Frequency Allocation – Routing – Handover – Security – GPRS – DECT architecture – Protocol Architecture

UNIT III : WIRELESS LAN **9**

Wireless LAN – IEEE 802.11 Standards – System Architecture – Protocol Architecture – Physical Layer – MAC Layer – services – HIPERLAN – AdHoc Network – Blue Tooth.

UNIT IV : NETWORK LAYER **9**

Mobile IP – Goals, assumptions and requirements – Entities _ IP packet delivery – Agent discovery – registration – Tunneling and Encapsulation – Optimizations _ IPV6.0 – Dynamic Host Configuration Protocol - Routing – DSDV – DSR – Alternative Metrics.

UNIT V : TRANSPORT AND APPLICATION LAYERS **9**

TCP over Wireless Networks – Indirect TCP – Snooping TCP – Mobile TCP – Fast Retransmit / Fast Recovery – Transmission/Timeout Freezing – Selective Retransmission – Transaction Oriented TCP – WAP – WAP Architecture – WDP – WTLS – WTP – WSP – WML – WML Script – WAE – WTA.

TOTAL: 45 HOURS

REFERENCES:

1. Jochen Schiller, “Mobile Communications”, Second Edition, Prentice Hall of India Pearson Education, 2003.
2. William Stallings, “Wireless Communications and Networks”, Second Edition, Prentice Hall of India / Pearson Education, 2004.
3. Kaveh Pahlavan, Prasanth Krishnamoorthy, “Principles of Wireless Networks”, Pearson Education, 2003.
4. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, New York, 2003.

CA35C7	PRINCIPLES OF COMPILER DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge in programming components.
- To study about components of compilation process.
- To study about optimization of coding.

Course Outcome		Cognitive Skill
CO-01	To gain knowledge in programming components	R,U
CO-02	To understand the basic concepts of compilation process with phases	R,U
CO-03	To study the process involved in lexical analysis phase	R,U
CO-04	To study the concept of regular expression and automata	R,U
CO-05	To study the process involved in syntax analysis phase	U,A,E
CO-06	To study the methods of top down and bottom up parsers	U,A,E
CO-07	To study the process involved in intermediate code generation phase	U,A,E
CO-08	To study the intermediate code generation for different programming statements.	U,A,E
CO-09	To study the process involved in code optimization phase	U,A,E
CO-10	To study the concept of code generation with examples.	U,A,E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	L	L	L	L	L	L	N	M	N	N	M	N	M
CO-02	L	L	L	L	L	L	N	M	N	N	M	N	M
CO-03	M	M	M	M	L	L	N	M	N	N	M	N	M
CO-04	M	M	M	M	L	L	N	M	N	N	M	N	M
CO-05	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-06	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-07	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-08	M	M	M	M	L	L	M	M	N	N	M	N	M

CO-09	M	M	M	M	L	L	M	M	N	N	M	N	M
CO-10	M	M	M	M	L	L	M	M	N	N	M	N	M

UNIT I: INTRODUCTION **9**

Basic concepts of Compiler- Analysis of source program- Phases of a compiler – Cousins of Compiler- Grouping of Phases- Compiler Construction Tools-Syntax Definition

UNIT II: LEXICAL ANALYSIS **9**

Role of Lexical Analyzer-Input Buffering-Specification of tokens- language for specifying lexical analyzers- regular expressions- NFA-DFA-reduced DFA-Design of lexical analyzer.

UNIT III: SYNTAX ANALYSIS **9**

Role of Parser- Context free grammars –Writing a Grammar- derivation and parse trees – - top-down parsing Bottom Up Parsing – operator precedence parsing —LR parsers.

UNIT IV: INTERMEDIATE CODE GENERATION **9**

Intermediate languages-– translation of Declaration - assignment statements, Boolean Expressions, Case Statements - Back Patching – Procedure calls

UNIT V: CODE OPTIMIZATION AND CODE GENERATION **9**

Introduction – Sources of optimization –Peephole Optimization - optimization of basic blocks – loop optimization – Design issues of code generation - runtime storage Management - - Basic blocks _ flow graph-Next use information – A simple code Generator.

TOTAL: 45 HOURS

REFERENCES:

1. Alferd V.Aho, Jeffery D.Ullman, "Principles of Compiler Design", Pearson Education, New Delhi, 2008.
2. D. Chithra, "Principles of Compiler Design, CBS Publishers,2011
3. Dr. O. G. Kakde., Compiler Design Fourth Edition.,2008

		L	T	P	C
CA35C8	**INFORMATION SYSTEM SECURITY**	**3**	**0**	**0**	**3**

OBJECTIVES

- To learn Fundamentals of information system
- To understand mobile and wireless systems
- To Study about IS security
- To study about network security

Course Outcome		**Cognitive Skill**
CO-01	To learn Fundamentals of information system	R,U
CO-02	To understand the security concepts for mobile and wireless systems	R,U
CO-03	To Study about IS security	R,U

CO-04	To understand the different security and authentication methods in resources	R,U
CO-05	To study about network security	R,U

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO - L	PO-M
CO-01	S	M	L	L	M	L	S	M	L	M	M	L	L
CO-02	M	M	S	M	L	M	S	M	M	L	M	M	L
CO-03	S	L	S	M	S	S	M	S	M	S	S	S	S
CO-04	L	M	M	L	M	M	S	S	S	S	M	L	L
CO-05	L	L	M	M	L	S	S	M	S	M	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: HISTORY OF INFORMATION SYSTEMS (IS) 9

Importance and basics of IS – global IS –threats to IS – information level threats VS network level threats – IS security: threats and attacks - classification of threats – protecting IS security

UNIT II: SECURITY CONSIDERATION IN MOBILE AND WIRELESS SYSTEMS 9

Security challenged posed by mobile devices – registry settings – authentication service security – mobile devices security implications – organizational measures and security policies – laptops – use of RFID in mobile

UNIT III: BASIC PRINCIPLES OF IS SECURITY 9

Pillars of IS – information classification – terms for information classification – criteria for classification of data and information – data obfuscation – event classification – terms and definitions for risk analysis – risk management and risk analysis – approaches and considerations – auditing

UNIT IV: PHYSICAL SECURITY 9

Natural disasters and control – basic tenets of physical security of IS resources – physical entity controls – perimeter security – elements of perimeter security – access control – user identification and user authentication – biometric identification and authentication – biometrics techniques – matching and enrollment process – key success factors – benefits of biometrics .

UNIT V: NETWORK SECURITY 9

Basic concepts – cryptography – roll of cryptography – digital signature – cryptographic algorithms – need for intrusion monitoring – intrusion detection for IS – firewalls – DMZ – firewalls via routers – overview of wireless technology – attacks on wireless networks – case study

TOTAL: 45 HOURS

REFERENCES:

1. "Information system security – Security Management, metrics , frameworks and best practices", Nina godbole, Wiley India Pvt Ltd., Newdelhi, 2009
2. Cryptography and Network Security Principles and Practices, Fourth EditionBy William Stallings Prentice hall, 2005, Pearson Education Asia.
3. Gollman Dieter: "Computer Security", Third Edition, 2011, John Wiley & Sons Ltd.
4. Johannes A Buchmann, "Introduction to cryptography," 2004, Spr

CA35C9	INTERNET OF THINGS	L	T	P	C
		3	0	0	3

OBJECTIVES

- The primary objective of this syllabus is to capture the state-of-the-art in Internet of Things, its applications, devices, architectures, and technologies.
- To identify potential research directions and technologies that will facilitate insight generation in various domains from science, industry, business, and consumer applications.

Course Outcome		**Cognitive Skill**
CO-01	Ability to Study about IOT Ecosystem Concepts	U,R,A
CO-02	Ability to find Enablers and solutions	U,R,A,E
CO-03	Ability to know about IOT Data and Knowledge management	U,R,E,A
CO-04	Ability to know the Bilding IOT	U,R,An
CO-05	Can be able to know the Security Concepts	A,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M

CO-04	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT-I: IoT ECOSYSTEM CONCEPTS AND ARCHITECTURES 9

Internet of Things: An Overview, Open Source Semantic Web Infrastructure for Managing IoT Resources in the Cloud, Device/Cloud Collaboration Framework for Intelligence Applications, Fog Computing: Principles, Architectures, and Applications

UNIT-II: IoT ENABLERS AND SOLUTIONS 9

Technology: Programming Frameworks for Internet of Things, Virtualization on Embedded Boards as Enabling Technology for the Cloud of Things, Micro Virtual Machines (MicroVMs) for Cloud Assisted Cyber-Physical Systems (CPS)

UNIT-III: IoT DATA AND KNOWLEDGE MANAGEMENT 9

Stream Processing in IoT: Foundations, State-of-the-art, and Future Directions, A Framework for Distributed Data Analysis for IoT

UNIT-IV: BUILDING IoT 9

Devices: Sensors and actuators - Physical devices - Arduino Microcontroller platform - Arduino IDE - Programming - APIs and Packages - Introduction to other microcontroller platforms - Raspberry Pi - Intel Galelio Gen 2, Applications: Applied Internet of Things, Internet of Vehicles and Applications, Cloud-Based Smart Facility Management

UNIT-V: IoT SECURITY AND APPLICATIONS 9

Security and Privacy in the Internet of Things: A Survey, Internet of Things- Robustness and Reliability, Governing Internet of Things: Issues, Approaches and New Paradigms, TinyTO: Two way Authentication for Constraint Devices in the Internet of Things, Obfuscation and Diversification for Securing the Internet of Things

TOTAL: 45 HOURS

REFERENCES:

1. Rajkumar Buyya and Amir Vahid Dastjerdi, ”Internet of things: Principles and Paradigms”, Todd Green Publisher, 2016.
2. Arshdeep Bagha and Vijai Madisetti, ”Internet of Things: A Hands on Approach”, University Press, 2015.
3. Manoel Carlos Ramon - Intel Galileo and Intel Galileo Gen 2 -API Features and Arduino Projects for Linux Programmers - A press - 2014.
4. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017.
5. Eben Upton, Gareth Halfacree ”Raspberry Pi User Guide”, Wiley, 2016

CA35D1	CRYPTOGRAPHY AND NETWORK SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES

- To learn the techniques and standard algorithms behind Cryptography.
- To learn Encryption Techniques
- To Learn the Digital signatures
- To learn Network Security
- To Learn System Security.

Course Outcome		Cognitive Skill
CO-01	Understand revolving techniques of cryptography	U
CO-02	Remember related mathematical theorems of cryptosystem	R
CO-03	Compare and construct encryption system techniques	An, S
CO-04	Analyze the characteristic of the services.	An
CO-05	Analyze and understand various protocols	An, U
CO-06	Evaluate the authentication and hash algorithms.	E
CO-07	Compare and construct different IEEE standards and E- mail security.	An, A
CO-08	Evaluate the IP security modes and security protocols	E
CO-09	Summarize the instruction detection systems	S
CO-10	Analyze various security applications	An

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	M	L	M	S	S	M	M	S	M	L	M	M
CO-02	S	M	L	M	M	S	M	M	S	L	M	M	M
CO-03	M	L	M	L	S	S	M	M	M	M	L	M	M
CO-04	S	M	L	M	S	S	M	M	S	M	M	L	M
CO-05	M	S	M	L	M	S	L	M	S	M	L	M	M
CO-06	M	M	L	S	S	S	M	S	M	M	L	M	L

CO-07	M	S	S	L	S	M	S	M	S	M	M	L	M
CO-08	S	M	L	M	M	S	M	M	S	M	L	M	M
CO-09	M	S	M	L	S	M	M	L	M	M	M	L	M
CO-10	S	M	L	M	S	S	M	M	S	M	M	L	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I: FUNDAMENTALS AND MATHEMATICS OF CRYPTOGRAPHY 9

Overview – Cryptographic attacks - Services and mechanisms – Techniques - Classical Crypto Systems – Substitution Ciphers –Transposition Ciphers - Stream and Block Ciphers – Introduction to number theory: Linear congruences – Chinese Remainder theorem – Modular arithmetic - Modular exponentiation – Fermats and Eulers theorem.

UNIT II: ENCRYPTION TECHNIQUES 9

Data Encryption Standard – Advanced Encryption Standard – Confidentiality using Symmetric Encryption - Public-Key Cryptography and RSA – Key Management - Diffie-Hellman Key Exchange – Elliptic Curve Cryptography – Kerberos - X.509 Authentication Service.

UNIT III: HASH FUNCTIONS AND SIGNATURES 9

Message Authentication and Hash Functions –Secure Hash Algorithms – SHA-512 - Digital Signatures and Authentication Protocols – Digital Signature Standard – Comparison - Process - Services - Attacks on Digital Signature - Digital Signature Schemes.

UNIT IV: NETWORK SECURITY 9

Security at the application layer: E-Mail - Pretty Good Privacy – S/MIME – Security at the transport layer: SSL Architecture – Protocols – Message Formats - TLS – Security at the Network Layer: IPSec –modes - Authentication Header (AH) – Encapsulating Security Payload (ESP) –Security Association – Security Policy – Internet Key Exchange.

UNIT V: SYSTEM SECURITY 9

Intruders – Intrusion Detection – Password Management – Malwares and Related Threats – DOS Attacks - Distributed Denial of Service Attacks - Firewalls – Firewall Types-Configuration and Implementation - Demilitarized Zone - Firewall limitations - Intrusion Deduction System.

TOTAL: 45 HOURS

REFERENCES:

1. William Stallings, "Cryptography and Network Security – Principles and Practices", Fourth Edition, Pearson Education, 2006.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", Second Edition, Tata Mc Graw Hill, 2010.
3. Atul Kahate, "Cryptography and Network Security", Tata McGraw Hill, 2003.
4. Joseph Migga Kizza, "A Guide to Computer Network Security", Springer International Edition, 2010.
5. Charles B. Pfleeger, Shari Lawrence Pfleeger, "Security in Computing", Fourth Edition, Pearson Education, 2007

CA35D2	SOFTWARE PROJECT MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To gain knowledge in software development.
- To study about project management.
- To study project planning and control.

	Course Outcome	Cognitive Skill
CO-01	Evaluation and Planning of Project	R,U
CO-02	Project life cycle and effort estimation	U,R,A
CO-03	Activity planning and risk management	U,A
CO-04	Project management and control	An, E
CO-05	Staffing in software projects	An, E

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	M	S	S	S	M	M	M	S	M	M	S	S	S
CO-02	S	S	M	M	S	S	S	M	M	M	M	S	M
CO-03	S	S	S	S	M	M	M	M	M	S	M	S	S
CO-04	M	M	M	L	M	S	S	S	S	S	S	M	L
CO-05	S	M	S	S	S	M	M	S	S	M	S	M	S

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT I : PROJECT EVALUATION AND PROJECT PLANNING 9

Importance of Software Project Management – Activities Methodologies – Categorization of Software Projects – Setting objectives – Management Principles – Management Control – Project portfolio Management – Cost-benefit evaluation technology – Risk evaluation – Strategic program Management – Stepwise Project Planning.

UNIT II : PROJECT LIFE CYCLE AND EFFORT ESTIMATION 9

Software process and Process Models – Choice of Process models – mental delivery – Rapid Application development – Agile methods – Extreme Programming – SCRUM – Managing interactive processes – Basics of Software estimation – Effort and Cost estimation techniques – COSMIC Full function points – COCOMO II A Parametric Productivity Model – Staffing Pattern.

UNIT III : ACTIVITY PLANNING AND RISK MANAGEMENT 9

Objectives of Activity planning – Project schedules – Activities – Sequencing and scheduling – Network Planning models – Forward Pass & Backward Pass techniques – Critical path (CRM) method – Risk identification – Assessment – Monitoring – PERT technique – Monte Carlo simulation – Resource Allocation – Creation of critical patterns – Cost schedules.

UNIT IV : PROJECT MANAGEMENT AND CONTROL 9

Framework for Management and control – Collection of data Project termination – Visualizing progress – Cost monitoring – Earned Value Analysis- Project tracking – Change control- Software Configuration Management – Managing contracts – Contract Management.

UNIT V : STAFFING IN SOFTWARE PROJECTS 9

Managing people – Organizational behavior – Best methods of staff selection – Motivation – The Oldham-Hackman job characteristic model – Ethical and Programmed concerns – Working in teams – Decision making – Team structures – Virtual teams – Communications genres – Communication plans.

TOTAL: 45 HOURS

REFERENCES:

1. Robert K. Wysocki "Effective Software Project Management" – Wiley Publication,2011.
2. Walker Royce: "Software Project Management"- Addison-Wesley, 1998.
3. Gopalaswamy Ramesh, "Managing Global Software Projects" – McGraw Hill Education (India), Fourteenth Reprint 2013.
4. Bob Hughes, Mike Cotterell and Rajib Mall: Software Project Management – Fifth Edition, Tata McGraw Hill, New Delhi, 2012.

CA35D3	DATA MINING AND DATA WAREHOUSING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To expose the good overview of the ideas and techniques of Data Mining.
- To Study about Classification and clustering.
- To Study about Data Warehousing
- To study about Applications of Data Mining.

Course Outcome		Cognitive Skill
CO-01	Database Technology evolutionary path, types of data to be mined, general classification of tasks – leads of Data mining.	U,R,A
CO-02	Applying preprocessing Statistical methods discover interesting patterns from large amount of data to analyze and extract patterns.	U,R,A,E
CO-03	To evaluate systematically supervised and unsupervised models – Evaluate and implement the emerging and newly adopted methodologies.	U,R,E,A
CO-04	Explore Data warehousing and OLAP and devise efficient cost effective methods for maintaining data ware housing.	U,R,An
CO-05	Design & implement of a data mining application using sample, realistic datasets, apply proper data mining Algorithms.	A,E,S

R- Remember, U-Understand, A-Apply, An-Analyze, E-Evaluate, S- Synthesis

Mapping of Course Outcome with Programme Outcome

PO / CO	PO-A	PO-B	PO-C	PO-D	PO-E	PO-F	PO-G	PO-H	PO - I	PO-J	PO-k	PO -L	PO-M
CO-01	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-02	M	L	M	S	S	M	L	M	S	M	M	S	M
CO-03	S	M	S	S	M	M	L	M	S	S	M	L	M
CO-04	S	S	M	L	M	S	S	M	M	L	M	M	L
CO-05	M	L	S	M	L	M	L	S	S	S	L	S	M

S- Strong, M- Medium, L-Low, N- Not Relevant

UNIT1: INTRODUCTION 9

Relation To Statistics, Databases- Data Mining Functionalities-Steps In Data Mining Process-Architecture of a typical Data Mining Systems- Classification of Data Mining Systems – Overview of Data Mining Techniques.

UNIT II: DATA MINING CONCEPTS AND TECHNIQUES 9

Data Preprocessing-Data Cleaning, Integration, Transformation, Reduction, Discretization-Concept Hierarchies-Concept Description: Data Generalization And Summarization Based Characterization- Mining Association Rules In Large Databases.

UNIT III: PREDICTIVE MODELING 9

Classification And Prediction. Issues Regarding Classification and Prediction-Classification By Decision Tree Induction-Bayesian Classification-Other Classification Methods-Prediction-Clusters Analysis: Types of Data in Cluster Analysis-categorization of Major Clustering Methods: Partitioning Methods –Hierarchical Methods.

UNIT IV: DATA WAREHOUSING 9

Data Warehousing Components –Multi Dimensional Data Model- Data Warehouse Architecture-Data Warehouse Implementation- -Mapping the Data Warehouse to Multiprocessor Architecture- OLAP.–Need- Categorization of OLAP Tools.

UNIT V: APPLICATIONS 9

Applications of Data Mining-Social Impacts of Data Mining-Tools-An Introduction to DB Miner-Case Studies-Mining WWW-Mining Text Database-Mining Spatial Databases.

TOTAL: 45 HOURS

REFERENCES:

1. Jiawei Han, Micheline Kamber, “Data Mining: Concepts and Techniques”, Morgan Kaufmann Publishers, 2002.
2. Alex Berson, Stephen J. Smith, “Data Warehousing, Data Mining & OLAP”, Tata McGraw- Hill, 2004.
3. Usama M.Fayyad, Gregory Piatetsky – Shapiro, Padhrai Smyth and Ramasamy Uthurusamy, “Advances in Knowledge Discovery And Data Mining”, The M.I.T press, 1996.
4. Ralph Kimball, “The Data Warehouse Life Cycle Toolkit”, John Wiley & Sons Inc., 1998.
5. Sean Kelly, “Data Warehousing In Action”, John Wiley & Sons Inc., 1997.