MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL – 624 102

Master of Computer Applications (MCA)
Syllabus
(With Effect from 2021)

DEPARTMENT OF COMPUTER SCIENCE

MOTHER TERESA WOMEN'S UNIVERSITY
KODAIKANAL

DEPARTMENT OF COMPUTER SCIENCE

CHOICE BASED CREDIT SYSTEM (CBCS)

(2021-2022 ONWARDS)

MASTER OF COMPUTER APPLICATIONS (MCA)

1. About the Programme:

Master of Computer Applications (MCA) is a two year professional post-graduate programme for candidates aspiring to delve deeper into the world of computer applications. The programme is a blend of both theoretical and practical knowledge. The course objective of MCA is to provide necessary foundation, knowledge and skills needed to meet out the rewarding career requirements in Computer Science and Information Technology. The students will be equipped with the knowledge of latest tools, technologies and applications of Computer Science in IT field for better career prospects and research.

MCA Curricula would focus on learning aspect from various dimensions: Conceptual Learning, Skill based learning and Practical / Hands on exposure. As a positive impact of this programme, the students would inherit the ability to practice and develop software. They can also involve in interpretation and analysis of data and use the techniques, skills and modern Software tools for various applications.

2. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To prepare the students excel in computer applications and to succeed in Industry / technical based profession.

PEO2: To train students with depth and breadth of knowledge in Computer Science so as to comprehend, analyze, design and create computing solutions for real life problems.

PEO3: To provide strong Mathematical and Technical foundation needed to solve related problems and also to pursue higher studies and research.

PEO4: To inculcate a professional and ethical attitude in students in order to work towards a broader social context.

PEO5: To develop students with leadership qualities and continuous learning ability on technology needed for a successful profession.

3. Eligibility:

Any UG Degree with Mathematics at +2 (Hr.Sec.) level.

4. General Guidelines for PG Programme

i. **Duration:** The programme shall extend through a period of 4 consecutive semesters and the duration of a semester shall normally be 90 days or 450 hours. Examinations shall be conducted at the end of each semester for the respective subjects.
ii. **Medium of Instruction:** English
iii. **Evaluation:** Evaluation of the candidates shall be through Internal Assessment and External Examination.

- **Evaluation Pattern**

Evaluation Pattern	Theory		Practical	
	Min	Max	Min	Max
Internal	13	25	13	25
External	38	75	38	75

- **Internal (Theory): Test (15) + Assignment (5) + Seminar/Quiz(5) = 25**
- **External Theory: 75**

- **Question Paper Pattern for External examination for all course papers.**
  Max. Marks: 75 **Time: 3 Hrs.**

S.No.	Part	Type	Marks
1	**A**	**10*1 Marks=10** Multiple Choice Questions(MCQs): 2 questions from each Unit	**10**
2	**B**	**5*4=20** Two questions from each Unit with Internal Choice (either / or)	**20**
3	**C**	**3*15=45** Open Choice: Any three questions out of 5 : one question from each unit	**45**
Total Marks			**75**

*** Minimum credits required to pass: 90**

- **Project Report**

A student should select a topic for the Project Work at the end of the third semester itself and submit the Project Report at the end of the fourth semester. The Project Report shall not exceed 75 typed pages in Times New Roman font with 1.5 line space.

- **Project Evaluation**

There is a Viva Voce Examination for Project Work. The Guide and an External Examiner shall evaluate and conduct the Viva Voce Examination. The Project Work carries 100 marks (Internal: 25 Marks; External (Viva): 75 Marks).

5. Conversion of Marks to Grade Points and Letter Grade

(Performance in a Course/Paper)

Range of Marks	Grade Points	Letter Grade	Description
90 – 100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

6. Attendance

Students must have earned 75% of attendance in each course for appearing for the examination. Students with 71% to 74% of attendance must apply for condonation in the Prescribed Form with prescribed fee. Students with 65% to 70% of attendance must apply for condonation in the Prescribed Form with the prescribed fee along with the Medical Certificate. Students with attendance less than 65% are not eligible to appear for the examination and they shall re-do the course with the prior permission of the Head of the Department, Principal and the Registrar of the University.

7. Maternity Leave

The student who avails maternity leave may be considered to appear for the examination with the approval of Staff i/c, Head of the Department, Controller of Examination and the Registrar.

8. Any Other Information

In addition to the above mentioned regulations, any other common regulations pertaining to the PG Programmes are also applicable for this Programme.

PROGRAMME OUTCOMES (POs)

PO1: Identify opportunities and use innovative ideas to create value and wealth for the betterment of the individual and society.

PO2: Ability to create and apply appropriate innovative techniques, resources and modern computing tools to computing activities with an understanding of opportunities and limitations.

PO3: An ability to recognize the need and to engage in independent learning for continual development as a computing professional.

PO4: Apply the management principles with computing knowledge to manage the projects in multidisciplinary environments.

PO5: Identify and analyze the computing requirements of a problem and solve using the state of art technologies.

PO6: Inherit expertise in developing software applications with required domain knowledge.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO1: Ability to analyze advanced algorithmic and mathematical concepts to design and apply effectively.

PSO2: Acquire academic excellence with an aptitude for higher studies and research.

PSO3: Ability to demonstrate team work, leadership qualities, professional ethics and strong human values.

PSO4: Apply the appropriate Software Engineering practices to deliver a Quality products catering to the needs of Industry and Society at a large.

Master of Computer Applications
(Two Years)

S. No.	Course Code	Title of the Course	Credits	Hours		Marks		Total
				L	P	Int.	Ext.	
SEMESTER – I								
1.	P21CAT11	**Core-1**: Object Oriented Programming in JAVA	4	5	-	25	75	100
2.	P21CAT12	**Core-2**: Mathematical Foundation in Computer Science	4	5	-	25	75	100
3.	P21CAT13	**Core-3**: Digital Principles and Computer Organization	4	5	-	25	75	100
4.	P21CAT14	**Core–4**: Data Structures and Computer Algorithms	4	5	-	25	75	100
5.	P21CAP11	**Core-5**: Java Programming Lab	4	-	6	25	75	100
6.	P21CSS11	**Supportive Course I**: Computer Skills for Web Designing and Video Editing	2	-	4	25	75	100
		Total	**22**	**30**				**600**
SEMESTER – II								
7.	P21CAT21	**Core-6**: Distributed Operating System	4	5	-	25	75	100
8.	P21CAT22	**Core-7**: Computer Networks	4	5	-	25	75	100
9.	P21CAT23	**Core-8**: Relational Database Management System (RDBMS)	4	4	-	25	75	100
10.	P21CAT24	**Core-9**: Python Programming	4	4	-	25	75	100
11.	P21CAP22	**Core-10**:– Python Programming Lab	4	-	6	25	75	100
12.		**Non Major Elective**	4	4	-	25	75	100
13.	P21CAS22	**Supportive Course – I:** RDBMS Lab	2	2	-	25	75	100
		Total	**26**	**30**				**700**
SEMESTER – III								
14.	P21CAT31	**Core-11**: Digital Image Processing	4	4	-	25	75	100
15.	P21CAT32	**Core-12**: Data Mining	4	4	-	25	75	100
16.	P21CAT33	**Core-13**: Machine Learning Techniques	4	4	-	25	75	100
17.	P21CAT34	**Core-14**: Software Engineering	4	4	-	25	75	100
18.	P21CAP33	**Core-15**: R Programming Lab	4	-	6	25	75	100
19.	P21CAE311 / P21CAE312 /	**Elective**-1 Cryptography and Network Security /	4	4	-	25	75	100

	P21CAE313	Big Data Analytics / Operation Research						
20	P21WSS33	**Supportive Course -III** Women Empowerment	2	4	-	25	75	100
	Total		**26**	**30**				**700**
SEMESTER – IV								
21.	P21CAE421 / P21CAE422 / P21CAE423	**Elective**-2 * Artificial Intelligence / Internet of Things / Deep Learning / MOOC courses $	4	4	-	25	75	100
23.	P21CAR41	Core-15: Project Work & Viva Voce	12	-	22	50	150	200
	Sub Total		**16**	**30**				**300**
	Total		**90**	**120**				**2300**

Non Major Elective

The candidates who have joined the PG Programme, can also undergo Non Major Elective offered by other Departments.

Non Major Elective (NME) offered by DEPARTMENT OF COMPUTER SCIENCE:

S.No.	Course code	Non Major Elective Course Name
1	P21CAN211	C Programming
2	P21CAN212	Photo Designing
3	P21CAN213	Big Data Analytics
4	P21CAN214	Digital Image Processing
5	P21CAN215	Mobile Computing
6	P21CAN216	Data Communication and Networking
7	P21CAN217	Cloud Computing

ADDITIONAL CREDIT COURSES

S.No.	Course Code	Title of the Course	Semester	Credits
1.	P21CAV11	VAP –I Object Oriented Programming using C++	I	2
2.	P21CAI21	Internship	II	2
3.	P21CAO31	MOOC	III	2
4.	P21CAV42	VAP –II Big Data Analytics Lab	IV	2

* The students with the CGPA of 7 and above and want to do their project in Industry during 4th Semester, may opt these elective paper in the third semester itself.

[$] For Elective – I / Elective- II, the students can take either one 4-credit course or two 2-credit courses in MOOC, with the approval of Department Committee.

Outside Class Hours (Attendance compulsory, Certificate Mandatory)

- Health, Yoga and Physical fitness.
- Library information access and utilisation
- Employability Training.
- Students Social Responsibility.

SEMESTER – I

COURSE CODE	P21CAT11	OBJECT ORIENTED PROGRAMMING WITH JAVA	L	T	P	C
CORE -I			5	-	-	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives	
1	To enable students understand the core principles of Java Language and to produce well designed applications.
2	To equip the students with the concepts of OOPs.
3	To provide a strong foundation with multithreading and applet concepts.
4	To enable students to understand server-side applications with database handling using Servlets, JSP and JDBC.

Unit I: **Fundamentals Of OOPs & Java**

What is OOP? - Difference between Procedural and Object oriented programming- Basic OOP concept - Object, classes, abstraction, encapsulation, inheritance, polymorphism. History of Java- Features of Java- Difference between C++ & JAVA- JDK - Environment Java Virtual Machine - Java Runtime environment - Java Identifiers and Keywords - Data Types in Java- Java coding - Conventions Expressions in Java

Unit II: Programming Concepts In Java

Control structures, decision making statements Arrays and its methods Garbage collection & finalize() method - Java classes - Define class with instance variables and methods - Object creation of class Accessing member of class Argument passing Constructors Method overloading - static data, static methods, static blocks this keyword

Unit III: Inheritance, Packages and Exception Handling

Inheritance Super class & subclass Abstract method and classes - Method overriding final keyword super keyword - Packages and Interfaces Importing classes User defined packages Modifiers & Access control (Default, public, private, protected, private/protected) Implementing interfaces User defined interfaces Adapter classes - Exception handling Types of Exceptions try, catch, finally, throw, throws keywords - Creating user-defined Exceptions - Nested try blocks - Multiple Catch statements - User Defined Exceptions

Unit IV: Multithreading and Applets

Multithreading Concept - Thread Life Cycle - Thread Priorities - Thread synchronization - Inter thread communication - Applets Applet life cycle Creating applet -Displaying it using Web Browser with appletwiewer.exe -The Html Applet Tag with all attributes. Passing Parameters to applet -Event handling in applet- Advantages and Disadvantages of APPLET

Unit V: Client-Server Architecture

JDBC Introduction - Java database Connectivity- JDBC Architecture – JDBC Components – JDBC Drivers – JDBC Packages - Simple JDBC application – Servlets -Servlets services – Servlet architecture – servlets life cycle– JSP – JSP architecture – JSP Tags

Text Book:

1. Herbet schildt, Java-The complete Reference, 10th Edition, Tata McGraw Hill, 2017.
2. Er.V.K.Jain , Programming Java Server pages & Servlets-Dream Tech Press, 2000.

Reference Books:

1. Steven Holzer, JAVA 2 Swing Servlets, JDBC, Java Beans Programming, Dream Tech Press Revised Edition, 2002.
2. Jaime Jaworski, Java 2 Platform Unleashed, Techmedi, Sams publisher, 1999.

Course Outcomes

After successful completion of the course, Student shall be able to:

CO1: Design, create, build and debug Java applications and applets - K3, K4
CO2: Write programs using OOPs concept, graphical user interface (GUI) components and Java's Event Handling Model - K3
CO3: Solve inter-disciplinary applications using the concept of inheritance - K3, K4
CO4: Apply JDBC to provide a program level interface for communicating with database using Java programming - K3
CO5: Develop software with Java programming language - K3

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	S	M	M	S	M	S
CO2	M	S	S	M	M	S	M	S	S	M
CO3	M	M	M	S	S	M	S	M	M	S
CO4	M	M	M	S	S	M	M	S	S	M
CO5	M	M	M	S	S	S	S	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks - 2 marks
M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT12	MATHEMATICAL FOUNDATION IN COMPUTER SCIENCE	L	T	P	C
CORE -II			5	-	-	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives

1	To impart basic foundation of Mathematics for Computer Science
2	To promote knowledge on the basic terminology of functions, relations and demonstrate knowledge of their associated operations.
3	To inculcate logical thinking and promote arithmetic knowledge
4	To solve mathematical problems, apply various methods of mathematical proof and communicate solutions in writing.

Unit I: Logic

IF Statements – Connectives – Truth Tables – Atomic and Compound Statements – WFF – Truth Table of a Formula – Tautology – Tautological Implications and Equivalence of Formulae – Predicate Calculus – Theory of Statement Calculus and Predicate Calculus – Automata Theorem.

Unit II: Normal Forms:

Principal Normal Forms – Theory of Inference – Open Statements – Quantifiers – Valid Formulae and Equivalence – Theory of Inference for Predicate Calculus.

Unit III: Graph Theory:

Basic Concepts – Data Structures for graphs - Connectivity - Matrix representation of Graphs – Traversals graph optimization – Travelling salesman problem and networks and the maximum flow problem - Trees: Definition – Spanning Trees – Rooted Trees – Binary Trees – Kruskala's algorithm – Traversals of Binary Trees.

Unit IV: Formal Languages:

Four class of grammars (phase structure, context sensitive, context free, regular) context free language – generation trees. Finite Automata: Representation of FA – Acceptability of a string by FA – Non deterministic FA (NDFA) - Acceptability of a string by NDFA. Equivalence of FA and NDFA – procedure for finding FA ~ NDFA.

Unit V: Lattices And Boolean Algebra:

Partial Order Relation – Poset - Lattices – properties – new lattices – Hasse Diagram - Modular and distribution lattices. Boolean algebra: Boolean polynomials –switching circuits.

Text Book:

1. M.K.Venkatraman, N.Sridharan, N.Chandrasekaran, Discrete Mathematics –The National Publishing Company, 2001.

Reference Books:

1. S.Arumugam & A.Thangapandi Issac, Modern Algebra, New Gamma Publishing House, 1992.
2. S.Arumugam and S.Ramachandran, Introduction to Graph Theory, Scitech Publications, Chennai, 2005.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand the complexity of computational problems - K2
CO2: Think about the design of formal language which would be able to address any real time problem and improve the working flow of computational models - K4
CO3: Use tree and graph algorithms to solve problems - K3
CO4: Evaluate Boolean functions and simplify expressions using the properties of Boolean algebra - K4
CO5: Solve mathematical problems, apply various methods of mathematical proof and communicate solutions in writing - K3

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	M	M	S	M	M	M
CO2	S	S	S	M	S	M	S	S	M	M
CO3	M	S	M	S	M	M	S	M	S	M
CO4	S	S	M	M	M	M	M	S	M	M
CO5	M	S	M	S	S	S	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT13	DIGITAL PRINCIPLES & COMPUTER ORGANIZATION	L	T	P	C
CORE -III			5	-	-	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives	
1	To learn the organization of a computer and its principle components.
2	To understand the function of computer hardware and their building blocks.
3	To understand and appreciate Boolean algebraic expressions to digital design
4	To understand the hardware components of a digital system.

Unit I: Introduction to computers

Number System – Data types – Data Representations – Fixed point, floating point, Gray, Excess – Alphanumeric codes – Binary codes – Error Detection codes.

Unit – II :Arithmetic Logic Unit

Binary Half Adder , Full adder and their Designs – Positive and Negative Numbers, Binary Addition & subtraction Using 1s,2s,9s complements, binary Multiplication.

Unit – III: Memory Unit

Classification of memory: primary – secondary – cache memory – Associate memory – virtual memory – RAM, ROM. Control Unit: General Register Organization, Stack Organization, instruction formats, Addressing modes- Data Transfer and Manipulation instruction.

Unit – IV: I/O Devices

punched tape, Tape Recorders, Punched Cards , Card readers – Printers – CRT Devices – Digital to Analog Converters, Analog to Digital Converters

Unit – V: Parallel Processing

Introduction to parallel processing – parallelism in Uniprocessor System – parallel Computer Structure.

Text Books:

1. Leach, Malvino, Saha, Digital Principles and Applications (SIE) | 8th Edition, by McGraw Hill Education, 2014
2. Mano M Morris, Computer System Architecture, Third Edition, by Pearson, 2017.

Reference Books:

1. Thomas C. Bartee – Digital Computer Fundamentals, McGraw Hill, 2016

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand the processing of Computer and the function of Memory and its types - K2
CO2: Know about the function and organization of Input Output devices - K2
CO3: Understand the digital representation of data in a computer system - K2
CO4: Identify, understand and apply different number systems and codes - K3
CO5: Understand computer arithmetic formulate and solve problems - K3, K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	M	M	M	M	M	S
CO2	S	M	S	M	M	M	M	M	M	S
CO3	S	M	S	S	M	S	M	S	M	S
CO4	S	S	S	S	S	M	M	S	M	S
CO5	M	S	M	S	S	S	M	S	S	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks

M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT14	DATA STRUCTURES & COMPUTER ALGORITHMS	L	T	P	C
CORE -IV			5	-	-	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives

1	To Learn and practice definition of stacks and queue.
2	To understand the use of Linked Lists
3	To learn trees and graphs in data structures
4	To inculcate the ability to search and sorting techniques.

Unit I: Introduction

Introduction, pseudo code, Abstract data type, model for ADT - Algorithm efficiency - Performance analysis - asymptotic notations.

Unit II :Stacks & Queues

Stacks, Basic operations, array implementation, linked list implementation, applications - Queues, Basic operations, array implementation, linked list implementation, applications - Recursion, designing recursive Algorithms

Unit III: Linked Lists

Array implementation, Linked list implementation, Linked list algorithms, processing a linked list, linear list applications, complex linked list structures.

Unit IV: Trees & Graphs

Trees, concepts, binary trees, binary tree traversal, Expression trees, changing general tree to binary tree, Binary search trees, AVL trees-Heaps, definition, structure, heap algorithms, heap applications Graphs, Terminology, operations, storage structures, applications-Dijkstra algorithm, minimum cost spanning trees

Unit V: Searching and Sorting

Linear List searches, Hashed list searches, Collision resolution techniques. Sorting: Insertion sort, selection sort, quick sort, heap sort, radix sort, merge sort

Text Books:

1. Data Structures And Algorithms Made Easy - Narasimha Karumanchi, 5th Edition, CareerMonk.com, 2017.
2. Richard F. Gilberg, Behrouz A. Forouzan, "Data Structures, A Pseudocode Approach with C", Second Edition, Brooks /Cole Publishing Company, 2007 .
3. Bhagath Singh and Thomas L. Naps. "Introduction to Data Structures", West Publishing Company, 1985.

Reference Books:

1. Sahni, "Data Structures, Algorithms and Applications in C++", Tata McGraw Hill, 1998.
2. Ellis Horowitz & Sartaj Shani, "Fundamentals of Data Structures", Galgotia Publications, 1994.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: demonstrate linear data structures linked list, stack and queue - K2
CO2: implement tree, graph, hash table and heap data structures - K2
CO3: apply brute force and backtracking techniques - K2
CO4: demonstrate greedy and divide-conquer approaches - K2
CO5: implement dynamic programming technique - K2

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	M	S	M	S	S	S
CO3	S	M	M	M	M	S	M	M	S	S
CO4	M	S	M	S	S	S	M	S	S	S
CO5	S	M	S	S	M	M	M	S	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAP11	JAVA PROGRAMMING LAB	L	T	P	C
CORE -V			-	-	6	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives	
1	To understand the concept of object-oriented paradigm in the Java programming language.
2	To use the Java SDK environment to create, debug and run simple Java programs.
3	To develop an engineering approach to solve problems.
4	Able to develop programs using API as well as java Standard Library.

List of Programs:

1. Classes and objects, constructors
2. Method overloading, Inheritance
3. Polymorphism
4. Packages and interfaces
5. String handling
6. Exception handling
7. Multithreading
8. Event Handling
9. Applet Programming
10. Input/output streams
11. Networking (TCP, UDP)
12. JDBC

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Solve problems using OOPs concept in Java K3
CO2: Implement simple software using JAVA K3
CO3: Implement the Input/Output functions with file manipulations using I/O Streams K3
CO4: Implement the GUI programming applications using AWT packages. K3
CO5: Read and make elementary modifications to Java programs that solve real-world problems. K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	S	M	M	S	S	S
CO2	S	S	M	S	S	S	M	S	M	S
CO3	S	S	M	M	S	S	S	S	S	M
CO4	M	S	M	S	S	M	S	M	S	S
CO5	S	S	M	M	S	M	S	S	M	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

SEMESTER – II

COURSE CODE	P21CAT21	DISTRIBUTED OPERATING SYSTEM	L	T	P	C
CORE - VI			5	-	-	4
COGNITIVE LEVEL		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives

1	To understand the communication of different hardware and software in distributed environment.
2	To learn the distributed resource management components.
3	To gain knowledge on modern operating system working principles.
4	To analyze the current popular distributed systems such as peer-to-peer (P2P) systems.

Unit I: Introduction

Introduction – Operating System Definition – Functions of Operating System – Types of Advanced Operating System – Design Approaches – Synchronization Mechanisms – concepts of a Process – Critical Section Problem – Process Deadlock – Models of Deadlock – Conditions for Deadlock – System with single-unit requests, Consumable Resources , Reusable Resources.

Unit – II : Distributed Operating Systems

Introduction- Issues – Communication Primitives – Inherent Limitations – Lamport's Logical Clock , Vector Clock, Global State , Cuts – Termination Detection – Distributed Mutual Exclusion – Non Token Based Algorithms – Lamport's Algorithm - Token Based Algorithms –Distributed Deadlock Detection – Distributed Deadlock Detection Algorithms – Agreement protocols.

Unit – III: Distributed Resource Management

Distributed Resource Management – Distributed File Systems – Architecture – Mechanisms – Design Issues – Distributed shared Memory – Architecture – Algorithm – Protocols – Design Issues – Distributed Scheduling – Issues – Components – Algorithms.

Unit – IV: Failure Recovery And Fault Tolerance

Failure Recovery and Fault Tolerance – Concepts – Failure Classifications – Approaches to Recovery – Recovery in Concurrent Systems – Synchronous and Asynchronous Check pointing and Recovery –Check pointing in Distributed Database Systems – Fault Tolerance Issues – TwoPhase and Nonblocking Commit Protocols – Voting Protocols – Dynamic Voting Protocols.

Unit – V: Multiprocessor and Database OS

Multiprocessor and Database Operating Systems –Structures – Design Issues – Threads – Process Synchronization – Processor Scheduling – Memory management – Reliability/Fault Tolerance – Database Operating Systems – concepts – Features of Android OS, Ubuntu, Google Chrome OS and Linux operating systems.

Text Books:

1. Mukesh Singhal and Niranjan Shivaratri, "Advanced Concepts in Operating Systems", McGraw Hill, 2017
2. Andrew S. Tanenbaum, Distributed Operating System, Pearson, 1994

Reference Books:

1. Abraham Silberschatz, Peter B.Galvin, G.Gagne, "Operating Systems Concepts", 9th Edition John Wiley & Sons Inc publications, 2013.

2. Andrew S.Tanenbaum, "Modern Operating Systems", 4th Edition Pearson Education India, 2016

Course Outcomes:

On the successful completion of the course, students will be able to:

CO1: Understand the Operating System Structure and its Services - K1
CO2: Understand the efficient Scheduling of Multiple Process Execution. - K2
CO3: Understand the efficient allocation of available memory among multiple processes- K3
CO4: Understand the Device Management System - K3
CO5: Compare and Contrast the features of Windows and LINUX operating Systems in terms of their services. - K4

Mapping of COs with POs and PSOs

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	M	M	M	S	S	M
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	S	S	M	M	M	M	S	M	M
CO4	S	S	M	S	M	S	M	S	S	S
CO5	S	S	S	S	S	S	M	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT22	COMPUTER NETWORK	L	T	P	C
CORE - VII			5	-	-	4
COGNITIVE LEVEL	K1: Recall K2: Understand K3: Apply K4: Analyze					

Objectives	
1	To describe and analyze the hardware, software components of a network and their interrelations.
2	To learn and analyze the data link, network, and transport layer protocols
3	To design and implement data link or network layer protocols within a simulated networking environment
4	To use Data Communication system along with its components.

Unit I: Introduction To Data Communications And Networking:

Evolution of Computer Networks, General Principles of Network Design: Topologies, Network Models (ISO-OSI, TCP/IP), Network Architecture & Standardization (IEEE802.x).

Unit II: Physical Layer:

Theoretical Basis for Data Communication-Data, Throughput, Bandwidth, Bit rate, Baud Rate, Data Rate measurement – Multiplexing, Transmission Media (Guided Media, Unguided Media: Wireless), Switching (Circuit, Message, Packet).

Unit III: Data Link Layer:

Data Link Layer Design Issues, Error detection and Correction, Data Link Control, Elementary Data Link Protocols, Network devices: Repeater, Hubs, Bridges, Switches, Routers, Gateways, Backbone networks and Virtual LANs, Wireless WANs. Network layer: Network Layer Design Issues, Logical Addressing, Internet Protocol, Address Mapping, Error Reporting and Multicasting, Delivery, Forwarding, Routing Algorithms.

Unit IV: Transport & Application Layers

TRANSPORT LAYER: Transport Service, Elements of Transport Protocols, UDP, TCP.
APPLICATION LAYER: DNS, Remote Logging, File Transfer, SNMP, Multimedia

Unit V: Security:

Cryptography – Basics of Cryptography – Conventional Cryptography – Public Key Cryptography, Network Security – Types of Network Security - , Kerbers; Internet Security IPSec, PGP, VPN, Firewalls

Text Book:

1. Behrouz A.Forouzan, “Introduction to Data Communications and Networking”, Fourth Edition, McGraw - Hill Education (India), New Delhi, 2007.
2. Natalia Olifer & Victor Olifer, “Computer Networks: Principles, Technologies and Protocols”, First Edition, Wiley India Pvt. Ltd., New Delhi, 2010.

Reference Books:

1. Andrew S. Tanenbaum, “Computer Networks”, Fifth Edition, PHI Learning Pvt. Ltd., / Pearson

Education Inc., New Delhi, 2013.
2. James F. Kurose, Keith W.Rose, Computer Networking: A Top-Down Approach Featuring the Internet", Pearson Education Inc., New Delhi, 4th Edition (2008).
3. Wayne Tomasi, "Introduction to Data Communications and Networking", Pearson Education Inc., New Delhi, First Edition, 2007.
4. Prakash Gupta, "Data Communications and Networking", PHI Learning Pvt., Ltd., New Delhi, First Edition, 2008.
5. Curt White, "Data Communications and Networking", CENGAGE Learning India Pvt. Ltd., New Delhi, First Edition, 2008.
6. L.L. Peterson & B.S.Davile, "Computer Networks", Fourth Edition, Elsevier Inc, 2007.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Have a good understanding of the OSI Reference Model and TCP/IP Model and in particular have a good knowledge of Layers. - K2

CO2: Analyze the requirements for a given organizational structure and select the most appropriate networking architecture and technologies. - K4

CO3: Design and implement network layer protocols within a simulated networking environment - K3

CO4: Explore the basis of computer networks and various protocols and understand the World Wide Web concepts - K5

CO5: Administrate a network and flow of information and predict ethical, legal, security and social issues related to computer networks - K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	M	S	M	M	M	S
CO2	M	S	S	M	M	M	M	S	M	M
CO3	M	M	S	S	S	M	S	M	M	S
CO4	S	M	S	M	M	S	M	M	M	S
CO5	M	M	S	S	S	M	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT23	RELATIONAL DATABASE MANAGEMENT SYSTEMS (RDBMS)	L	T	P	C
CORE- VIII			4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives

1	To Learn and practice data modeling using the entity-relationship and develop database designs.
2	To understand the use of Structured Query Language (SQL).
3	To apply normalization techniques to standardize the database.
4	To inculcate the ability to design and implement a database schema for real time problem

Unit I: Introduction

Overview, Database System vs. File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence and Database Language and Interfaces, Data Definitions Language, DML, Overall Database Structure. Data Modeling Using the Entity Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Concepts of Super Key, Candidate Key, Primary Key, Generalization, Aggregation, Reduction of an ER Diagrams to Tables, Extended ER Model

Unit – II : Relational data Model and Language

Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra, Relational Calculus, Tuple and Domain Calculus. Introduction to SQL: Characteristics of SQL, Advantage of SQL. SQL Data Type and Literals. Types of SQL Commands. SQL Operators and their Procedure. Tables, Views and Indexes. Queries and Sub Queries. Aggregate Functions. Insert, Update and Delete Operations, Joins, Unions, Intersection, Minus, Cursors, Triggers, Procedures in SQL/PL SQL

Unit – III: Data Base Design & Normalization

Functional dependencies, normal forms, first, second, third normal forms, BCNF, inclusion dependence, loss less join decompositions, normalization using FD, MVD, and JDs, alternative approaches to database design

Unit – IV: Transaction Processing Concept

Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Checkpoints, Deadlock Handling. Distributed Database: Distributed Data Storage, Concurrency Control, Directory System

Unit – V: Concurrency Control Techniques

Concurrency Control, Locking Techniques for Concurrency Control, Time Stamping Protocols for Concurrency Control, Validation Based Protocol, Multiple Granularity, Multi Version Schemes, Recovery with Concurrent Transaction,

Text Books:

1. Abraham Silberschatz, Henry F. Korth & Sudarshan, “Database System Concepts “, 6th Ed., McGraw Hill International Edition, 2013.
2. Date C J, “An Introduction to Database Systems”, 8th Edition, Pearson Edition publication..
3. Elmasri Ramez, Navathe Shamkant, “Fundamentals of Database Systems”, 7th Edition, Addision Wesley, 2017

Reference Books:

1. O’Neil, "Databases", Elsevier Pub, 1984.

2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems" 3rd Edition, McGraw Hill, 2014
3. Alexis Leon and Mathews Leon," Database Management Systems", Vikas Publishing House, 2008
4. Bipin C. Desai, "An Introduction to Database Systems", Gagotia Publications, 2015.
5. Arun Majumdar and Pritimoy Bhattacharyya , "Database Management System", McGraw Hill, 2017

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand the use of Structured Query Language (SQL) - K2
CO2: Create E/R models from application descriptions - K3
CO3: Apply normalization techniques to standardize the database - K3 & K4
CO4: Design and implement a database system for real time problem - K6
CO5: Create databases in an RDBMS and enforce data integrity - constraints and queries using SQL - K6

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	M	S	M	S	M	M
CO2	M	M	M	S	S	M	S	M	M	S
CO3	M	M	M	S	S	S	S	M	S	S
CO4	M	M	S	S	S	S	S	M	S	S
CO5	M	M	S	S	S	S	S	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT24	PYTHON PROGRAMMING	L	T	P	C
CORE - IX			4	-	-	4

Cognitive Level	K1: Recall	K2: Understand	K3: Apply	K4: Analyze

Objectives

1	To understand and use the basic of python.
2	To understand advance concepts of python and able to apply it for solving the complex problems.
3	To understand the reading and writing data through file handling.
4	To develop the critical thinking and analytical approach by using python libraries.

Unit I: Introduction

Understanding Python- Role of Python in AI and Data science -. Installation and Working with Python -The default graphical development environment for Python - IDLE - Types and Operation- Python Object Types- User Defined Classes - Understanding python blocks-. Python Program Flow Control- Conditional blocks using if, else and elseif -. Simple for loops in python - For loop using ranges, string, list and dictionaries- Use of while loops in python-. Loop manipulation using pass, continue, break and else - Programming using Python conditional and loops block

Unit – II : Python Functions, Modules & Packages

Function Basics-Scope, nested function, non-local statements - built-in functions -Arguments Passing, Anonymous Function: lambda - Decorators and Generators -. Module basic usage, namespaces, reloading modules. – math, random, datetime - Package: import basics - Python namespace packages - user defined modules and packages

Unit – III: Functions & Strings

Built-In Function, invoking built in functions- Module(Importing entire module or selected objects using from statement) -Functions from math, random, time & date module- Composition- User Define Function : Defining , invoking functions, passing parameters (default parameter values, keyword arguments) - Scope of variables, void functions and functions returning values Strings- Creating, initializing and accessing the elements; - String operators: +, *, in, not in, range, slice [n:m] -String built in functions & methods- Strings constants defined in string module Regular Expression and Pattern Matching

Unit – IV: List, Tuples, Sets, Dictionaries

Concept of mutable lists, creating, initializing and accessing the elements of list - List operations - List comprehensions- List functions & methods. Tuples - Immutable concept, creating, initializing and accessing the elements in a tuple - Tuple functions-Sets-Concept of Sets , creating, initializing and accessing the elements of- Sets operation - Membership, union, intersection, difference, and symmetric difference. Dictionaries- Concept of key-value pair, creating, initializing and accessing the elements in a dictionary - Traversing, appending, updating and deleting elements-Dictionary functions & Methods. Modules Executing modules as scripts, The Module Search Path, “Compiled” Python files Standard Modules- The dir( ) Function

Unit – V: I/O and File Handling

I/O and File Handling- Output Formatting- Reading and Writing Files

Unit-V - Errors and Exceptions- Syntax Errors, Exceptions, Handling Exceptions, Raising Exceptions- User-defined Exceptions, Defining Clean-up Actions(try - finally), Predefined Clean-up Actions. Introduction to Object Oriented concepts in Python 8.1 Object Oriented concepts 8.2

Objects, Python Scopes and Namespaces 8.3 Classes, Class Objects, Instance Objects, Method Objects, Class and Instance Variables
Text Books: 1. Mark Lutz, "Learning Python: Powerful Object Oriented Programming", 5th Edition, O'Reilly Publication, 2013 2. Gowrishankar S. Veena A., Introduction to Python Programming. CRC Press is an imprint of Taylor & Francis Group, an Informa business, 2019
Reference Books: 1. Martin C. Brown , "Python: The Complete Reference", McGraw Hill Education, 2018 2. NumPy, and Matplotlib, "Python Data Analytics: With Pandas", 2nd ed. Edition by Fabio Nelli, 2018

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand Demonstrate the concepts of python and modular programming - K2
CO2: Apply the concepts of concurrency control in python - K3
CO3: Solve the real-life problems using object-oriented concepts and python libraries - K3
CO4: Demonstrate the concept of IO, Exception Handling, database - K3
CO5: Analyze the given dataset and apply the data analysis concepts and data visualization - K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	M	M	S	M	M	M
CO2	S	S	S	M	M	M	S	S	M	M
CO3	M	S	M	S	M	M	S	M	S	M
CO4	S	S	M	M	M	M	M	S	M	M
CO5	M	S	M	S	S	S	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAP22	PYTHON PROGRAMMING LAB	L	T	P	C
CORE - X			-	-	6	4
Cognitive Level	K1: Recall K2: Understand K3: Apply K4: Analyze					

Objectives	
1	To understand the basic concepts of Python
2	To understand and analyze the underlying concepts in Python
3	To apply modules, functions and packages in Python
4	Able to Design and implement a database schema for a given problem-domain

List of Programs:

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball in Pygame

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Write, Test and Debug Python Programs - K3
CO2: Implement Conditionals and Loops for Python Programs - K4
CO3: Use functions and represent Compound data using Lists, Tuples and Dictionaries - K2
CO4: Read and write data from & to files in Python and develop Application using Pygame- K3
CO5: Write their own functions for complex programs - K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	M	M	M	M	S	M	M	M
CO2	M	S	S	M	S	S	M	S	S	S
CO3	M	M	S	S	S	M	S	S	S	S
CO4	S	S	M	M	M	S	M	S	M	M
CO5	M	M	M	M	S	S	M	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAS22	RELATIONAL DATABASE MANAGEMENT SYSTEMS LAB	L	T	P	C
SUPPORTIVE COURSE -II			2	-	-	2

Cognitive Level	K1: Recall	K2: Understand	K3: Apply	K4: Analyze

Objectives

1.	To become familiar with SQL fundamental Concepts.
2.	To Apply Normalization techniques to normalize a database
3.	To know the connectivity of databases with controls (DAO,ADO & RDO)
4.	The Student can Gain a good understanding of the architecture and functioning of Database Management Systems as well as associated tools and techniques

List of Programs

1. Queries using DDL commands
2. Queries using DML commands
3. Program using conditional control, interactive controls & sequential controls.
4. Program using excepting handling
5. Programs using explicit cursors & implicit cursors
6. Program using PL/SQL tables & records
7. Programs using database triggers
8. Program to design procedures using In, Out, Parameter
9. Program to design procedures using functions
10. Program to design procedures using packages
11. Program using ADO connectivity.
12. Program using DAO connectivity.
13. Program using RDO connectivity.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Describe the concepts of database technologies - K3
CO2: Apply PL/SQL including stored procedures, stored functions, cursors, packages -K3,K4
CO3: Apply constraints on a database using RDBMS -K3
CO4: Demonstrate the concept of Triggers and Subroutines -K4
CO5: Analyze and Select storage and recovery techniques of database system -K3

Mapping of CO's with PO's and PSO's:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	S	S	S	M	S	S	M
CO2	S	S	M	S	M	M	S	S	M	M
CO3	S	S	S	S	M	S	S	S	S	S
CO4	S	S	S	S	S	S	S	S	M	S
CO5	M	S	S	S	M	M	M	S	S	M

S – Strongly Correlating - 3 marks M – Moderately Correlating M- Moderately Correlating - 1 mark

SEMESTER -III

COURSE CODE	P21CST31	DIGITAL IMAGE PROCESSING	L	T	P	C
CORE -XI			4	-	-	4
Cognitive Level		K2: Understand K3: Apply K4: Analyse K6: Create				

Objectives

1.	To know the basic components of an image processing system.
2.	To Analyze and implement image processing algorithms
3.	To understand the differences between computer vision and image processing.
4.	To develop Application-Specific Algorithms for image processing

Unit-I : Introduction

The Origins of Digital Image Processing – Application of Digital Image Processing – Fundamental Steps in Digital Image Processing – Component of Image Processing System Fundamentals: Image Acquisition Using a Single Sensor – Image Acquisition Using Sensor Arrays

Unit-II : Image Sampling And Quantization

Basic concepts-Representing Digital Images – Spatial and Grey Level Resolution-Aliasing &more patterns – Zooming and Shrinking Digital Images. Basic Relationships Between Pixels: Neighbors of a Pixel – Adjacency, Connectivity, Regions and Boundaries – Distance Measures, Image Operations on a Pixel Basis

Unit-III : Color Image Processing

Fundamentals-color models: RGB color model-CMY and CMYK color model-HIS model-Color Image smoothing &color Image sharping. Image Enhancement In Spatial Domain: Gray Level Transformation – Image Negatives – Log Transformations –Piecewise-Linear transformation function- Enhancement Using Arithmetic/Logic Operations – Image Subtraction – Image Averaging

Unit-IV: Image Compression

Fundamentals- Image Compression Model-Compression-Measures-Compression Algorithm and its Types –Entropy Coding - Predictive Coding - Transform Coding - Layered Coding - Types of Redundancy Coding Redundancy – Inter pixel Redundancy – PsychoVisual Redundancy – Image Compression Models – The Source Encoder and Decoder – The Channel Encoder and Decoder

Unit-V: Image Segmentation

Detection of Discontinuities Point Detection – Line Detection – Edge Detection- Edge Detection –Stages in Edge Detection-Types of Edge detectors.- Representation Of Images: Chain Codes – Polygonal Approximation – Signatures – Boundary Segments – Skeletons

Text Books:

1. Rafael C.Gonzalez and Richard E.Woods , “Digital Image Processing”, Pearson, Second Edition, 2018.

Reference Books:

1. Anil K.Jain, “Fundamentals of Digital Image Processing”, PHI, 1995.

2. Sid Ahme M.A, "Image Processing", McGraw Hill Inc, 1995
3. Gonzalaz R and Wintz P., "Digital Image Processing", Addison Wesley, 2nd Ed, 1987

Course Outcomes:

After completion of the course, Student shall be able to:

CO1: Explain how digital images are represented and manipulated in computer. - K2
CO2: Understand different image enhancement techniques and image transforms - K2
CO3: Analyze the basic algorithms used for image processing and image compression with morphological image processing - K4
CO4: Writing a program to implement fundamental image processing algorithms - K3
CO5: Develop real world applications using different image processing techniques - K6

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S	M	M	S	S	S	S
CO2	S	S	M	S	M	S	S	S	S	S
CO3	S	M	M	M	S	S	S	M	S	M
CO4	M	S	S	S	M	M	S	S	S	S
CO5	S	M	S	S	M	S	M	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT32	DATA MINING	L	T	P	C
CORE - XII			4	-	-	4

Cognitive Level	K2: Understand	K3: Apply	K4: Analyze	K5:Evaluate

Objectives

1	To introduce the basic concepts of Data Mining techniques
2	To familiarize the types of the data to be mined and apply preprocessing methods on raw data
3	To identify and address problems with Data Mining Methods
4	Able to understand and analyze supervised and unsupervised models and estimate the accuracy of the algorithms

Unit I: Introduction

DATA MINING: Introduction – Kinds of data can be mined, Kinds of patterns can be mined, Technologies used, Kinds of application targeted, Major issues in data mining. Getting To Know Your Data: Data objects & attribute types. Basic statistical description of data, data visualization.

Unit – II : Data Preprocessing

Overview, Need for Preprocessing – Preprocessing Techniques: Data cleaning, Data Integration, Data Aggregation, Data Normalization, Data Generalization, Data Reduction, Data Transformation and Data Discretization – Preprocessing Types: Data Cleaning, Ignoring Tuples, Filling Missing Values, Noisy Data, Binning Method, Regression, Clustering.

Unit- III : Data Warehouse and OLAP

Basic Concepts, data warehouse modeling data cube and OnLine Analytical Processing, data warehouse design and usage – Online Analytical Processing vs. Online Transaction Processing – Types of OLAP Servers: Relational OLAP (ROLAP), Multidimensional OLAP (MOLAP), Hybrid OLAP (HOLAP), Specialised SQL Servers.

Unit – IV: Data Cube Technology and Association Rule Mining

Data Cube Technology: Data cube computation: Preliminary concepts, Data cube computation methods. Association: Basic concepts, Frequent itemset mining methods.

Unit – V: Classification and Cluster Analysis

Classification: Basic concepts – K-Nearest Neighbor, Decision Trees, Consumer Behaviour Classification. Cluster Analysis: Basic concepts, Applications of Cluster Analysis – Clustering methods: Partitioning method, Hierarchical Method, Density-based Method, Grid-Based Method, Model-Based Method, Constraint-Based Method.

Text Books:

1. "Data Mining Concepts and Techniques" by Jiaweihen, Michelin Kamber, Jian pie III edition, Elsevier publication.

Reference Books:

1. "Data mining methods" by Rajanchattamvelli, Narosa publishing house

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Preprocess the data with all data mining techniques K2
CO2: Evaluate different models used for OLAP and data preprocessing. K5
CO3: Categorize and carefully differentiate between situations for applying different data-mining techniques. K4

CO4: Design and implement systems for data mining. K3
CO5: Evaluate the performance of different data-mining algorithms. K4, K5

Mapping of COs with POs and PSOs:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	M	M	S	S	M
CO2	S	S	M	S	M	M	M	S	S	S
CO3	S	S	S	S	M	M	M	S	M	S
CO4	S	S	S	S	M	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT33	MACHINE LEARNING TECHNIQUES	L	T	P	C
CORE -XIII			4	-	-	4

Cognitive Level	K2: Understand K3: Apply K4: Analyze K5:Evaluate

Objectives

1	To Learn about Machine Intelligence and Machine Learning applications
2	To implement and apply machine learning algorithms to real-world applications.
3	To identify and apply the appropriate machine learning technique to classification, pattern recognition, optimization and decision problems.
4	To understand how to perform evaluation of learning algorithms and model selection.

Unit I: Introduction

Basic principles, Applications, Challenges with traditional approaches , Components of Machine Learning Techniques – Characteristics

Unit – II : Supervised Learning

Linear Regression (with one variable and multiple variables), Gradient Descent, Classification (Logistic Regression, Overfitting, Regularization, Support Vector Machines), Artificial Neural Networks (Perceptrons, Multilayer networks, back-propagation), Decision Trees

Unit- III : UnSupervised Learning

Clustering (K-means, Hierarchical), KNN (K-Nearest Neighbors), Hierarchical Clustering, Apriori Algorithm, Dimensionality reduction, Principal Component Analysis, Anomaly detection – Advantages and Disadvantages.

Unit – IV: Theory of Generalization

In-sample and out-of-sample error, VC inequality, VC analysis, Bias and Variance analysis

Unit – V: Applications and Advanced Topics

Spam filtering, recommender systems, and others. Advanced topics: Bias and fairness in Machine Learning

Text Books:

1.Tom M. Mitchell, ―Machine Learning, McGraw-Hill Education (India) Private Limited, 2013.
2.Haykin, S. (1994). Neural networks: a comprehensive foundation. Prentice Hall PTR.

Reference Books:

1. Ethem Alpaydin, ―Introduction to Machine Learning (Adaptive Computation and Machine Learning), The MIT Press 2004.
2. Stephen Marsland, ―Machine Learning: An Algorithmic Perspective, CRC Press, 2009.
3. Michael Affenzeller, Stephan Winkler, Stefan Wagner, Andreas Beham, "Genetic Algorithms and Genetic Programming", CRC Press Taylor and Francis Group.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Have a good understanding of the fundamental issues and challenges of machine learning concept K2

CO2: Understand, Analyse and identify the strengths and weaknesses of many popular machine learning approaches. K2, K4

CO3: Aware about the underlying mathematical relationships across Machine Learning algorithms and the paradigms of supervised and un-supervised learning. K2

CO4: Ability to design and implement various machine learning algorithms in a range of real-world applications. K4, K6

CO5: Perform evaluation of machine learning algorithms and model selection. K4

Mapping of COs with POs and PSOs:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO 2	PSO3	PSO4
CO1	S	S	M	S	M	M	M	S	S	M
CO2	S	S	M	S	S	M	M	S	S	S
CO3	S	S	S	S	M	S	M	S	M	S
CO4	S	S	S	S	M	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT34	SOFTWARE ENGINEERING	L	T	P	C
CORE -XIV			4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives

1	To understand the concepts and methods required for the construction of effective Software.
2	To understand the issues affecting the organization, planning and control of software.
3	To identify, formulate, and solve software engineering problems using a well-defined engineering process
4	To demonstrate the ability to work effectively as a team leader/ Software Analyst in professional environments.

Unit I: Introduction

Evolution and impact of Software Engineering, Socio-technical Systems, Critical Systems, Software Processes, and Software Life cycle Models, Software Project Management.

Unit – II : Requirements & Specification:

Software Requirements, Requirements Engineering Processes, Feasibility study, Requirements analysis and specification, System Models, Critical System Specification, Formal Specification.

Unit – III: Design And Analysis Aspects:

Architectural Design – Cohesion and coupling, Abstraction, Data flow Oriented Design, Distributed Systems Architecture, Application Architectures, Object-Oriented Design, Real-time Software Design, User Interface Design and Usability Engineering. Implementation and Testing: Verification and validation, Software Testing, Critical Systems validation.

Unit – IV: Software Reliability And Quality Management:

Musa's Reliability Model, Managing People, Software Cost Estimation- COCOMO Model, Quality Management, Process Improvement, Configuration Management, Software Maintenance.

Unit – V: Modern Trends And Emerging Technologies:

Humphrey's Capability Maturity Model, CMMI(Capability Maturity Model Integration), Agile software development, Extreme Programming (XP), Security Engineering, Service-oriented Software Engineering, Aspect-oriented Software Development.

Text Books:

1. Rajimmall, "Fundamentals of Software Engineering", PHI Learning Pvt. Ltd. New Delhi, 5th Edition,2018
2. Ian Sommerville, "Software Engineering", Pearson Education Inc., New Delhi, 10th Edition, 2017.

Reference Books:

1. Roger S.Pressman, "Software Engineering: A Practitioner's A.pproach", 7th International Edition, McGraw-Hill Education (Asia), Singapore, 2020.
2. Shari Lawrence P Fleeger, Joanne M. Atlee, "Software Engineering", Pearson Education Inc. New Delhi, 3rd Edition(2006).
3. Ben Shneiderman, Catherine Plaisant, "Designing the User Interface: Strategies for Effective Human-Computer Interaction", Pearson Education, Inc. New Delhi, 4th Edition (2006).
4. Pankaj Jalote, "Software Engineering", Wiley India Pvt. Ltd., New Delhi, First Edition, 2009.
5. Dines Bjorner, "Software Engineering: Volume-1, Volume-2 & Volume-3", Springer India Pvt.

Ltd., New Delhi, 2009.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understands the process to be followed in the software development life cycle - K2
CO2: Find practical solutions to the problems - K4
CO3: Adapt the basic software engineering methods and practices in their appropriate applications - K3
CO4: Distinguish the various software process models - K4
CO5: Analyze, design and maintain software systems - K3 & K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	M	M	M	S	M	M
CO2	M	S	M	M	S	M	S	M	M	M
CO3	S	S	M	S	M	M	M	S	M	M
CO4	S	M	S	M	M	M	M	S	M	M
CO5	S	M	S	M	M	S	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAP33	R PROGRAMMING LAB	L	T	P	C
CORE -XV			-	-	6	4
Cognitive Level	K1: Recall K2: Understand K3: Apply K4: Analyze					

Objectives

1	To provides the knowledge to Install R Programming.
2	To use R for simple programming tasks.
3	To extended R Libraries and Packages
4	To develop R Programs using Loop Constructs and to data exploration in R programs using Mathematical Functions.

Lab Exercises

1. Write a R program to take input from the user (name and age) and display the values. Also print the version of R installation.
2. Write a R program to get the details of the objects in memory.
3. Write a R program to create a sequence of numbers from 20 to 50 and find the mean of numbers from 20 to 60 and sum of numbers from 51 to 91.
4. Write a R program to create a vector which contains 10 random integer values between -50 and +50.
5. Write a R program to get the first 10 Fibonacci numbers.
6. Write a R program to get all prime numbers up to a given number (based on the sieve of Eratosthenes).
7. Write a R program to print the numbers from 1 to 100 and print "Fizz" for multiples of 3, print "Buzz" for multiples of 5, and print "FizzBuzz" for multiples of both.
8. Write a R program to extract first 10 English letter in lower case and last 10 letters in upper case and extract letters between 22^{nd} to 24^{th} letters in upper case.
9. Write a R program to find the factors of a given number.
10. Write a R program to find the maximum and the minimum value of a given vector.
11. Write a R program to get the unique elements of a given string and unique numbers of vector.
12. Write a R program to create three vectors a,b,c wih 3 integers. Combine the three vectors to become a 3×3 matrix where each column represents a vector. Print the content of the matrix.
13. Write a R program to create a list of random numbers in normal distribution and count occurrences of each value.
14. Write a R program to read the .csv file and display the content. 15. Write a R program to create three vectors numeric data, character data and logical data. Display the content of the vectors and their type.
16. Write a R program to create a 5 x 4 matrix , 3 x 3 matrix with labels and fill the matrix by rows and 2 × 2 matrix with labels and fill the matrix by columns.
17. Write a R program to create an array, passing in a vector of values and a vector of dimensions. Also provide names for each dimension.
18. Write a R program to create an array with three columns, three rows, and two "tables", taking two vectors as input to the array. Print the array.
19. Write a R program to create a list of elements using vectors, matrices and a functions. Print the content of the list.
20. Write a R program to draw an empty plot and an empty plot specify the axes limits of the graphic.

21. Write a R program to create a simple bar plot of five subjects marks.
22. Write a R program to create bell curve of a random normal distribution.
23. Write a R program to compute sum, mean and product of a given vector elements.
24. Write a R program to create a list of heterogeneous data, which include character, numeric and logical vectors. Print the lists.
25. Write a R program to create a Data frames which contain details of 5 employees and display the details.
26. Write a R program to create a Data Frames which contain details of 5 employees and display summary of the data.
27. Write a R program to create the system's idea of the current date with and without time.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand the basics in R programming in terms of constructs, control statements, string functions - K3
CO2: Understand the use of R for Big Data analytics - K4
CO3: Learn to apply R programming for Text processing - K4
CO4: Able to appreciate and apply the R programming from a statistical perspective - K3
CO5: Able to use R for inferential statistics - K3 & K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	S	M	S	M	M	M	S	M	S
CO2	M	S	M	M	S	S	S	M	S	M
CO3	S	M	S	S	M	S	M	S	S	S
CO4	S	M	S	M	M	M	S	M	M	M
CO5	M	S	S	S	S	S	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAE311	CHOICE -I	L	T	P	C
ELECTIVE - I		CRYPTOGRAPHY AND NETWORK SECURITY	4	-	-	4
Cognitive Level	K1: Recall K2: Understand K3: Apply K4: Analyse					

Objectives

1.	To learn about the Number Theory
2.	To Understand the basics of Cryptography
3.	To Understand Hash Functions and Cryptography
4.	To Know about Security Procedure and System Security.

Unit – I: Introduction & Number Theory

Services, Mechanisms and attacks – the OSI security architecture - Network security model - Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques, steganography). Finite Fields And Number Theory: Groups, Rings, Fields-Modular arithmetic-Euclid's algorithm-Finite fields - Polynomial Arithmetic – Prime numbers-Fermat's and Euler's theorem-Testing for primality - The Chinese remainder theorem- Discrete logarithms.

Unit – II: Block Ciphers & Public Key Cryptography

Data Encryption Standard-Block cipher principles-block cipher modes of operation-Advanced Encryption Standard (AES) - Triple DES – Blowfish - RC5 algorithm. Public key cryptography: Principles of public key cryptosystems-The RSA algorithm-Key management - Diffie Hellman Key exchange - Elliptic curve arithmetic - Elliptic curve cryptography.

Unit – III: Hash Functions And Digital Signatures

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – CMAC - Digital signature and authentication protocols – DSS – EI Gamal – Schnorr

Unit – IV: Security Practice & System Security

Authentication applications – Kerberos – X.509 Authentication services - Internet Firewalls for Trusted System: Roles of Firewalls – Firewall related terminology- Types of Firewalls - Firewall designs - SET for E-Commerce Transactions. Intruder – Intrusion detection system – Virus and related threats – Countermeasures – Firewalls design principles – Trusted systems – Practical implementation of cryptography and security.

Unit V: E-Mail, Ip & Web Security

E-mail Security: Security Services for E-mail-attacks possible through E-mail - establishing keys privacy-authentication of the source-Message Integrity-Non-repudiation-Pretty Good Privacy-S/MIME. IPSecurity: Overview of IPSec - IP and IPv6-Authentication Header-Encapsulation Security Payload (ESP)-Internet Key Exchange (Phases of IKE, ISAKMP/IKE Encoding). Web Security: SSL/TLS Basic Protocol-computing the keys- client authentication-PKI as deployed by SSL Attacks fixed in v3- Exportability-Encoding-Secure Electronic Transaction (SET).

Text Book(s):

1. William Stallings, Cryptography and Network Security, 6 th Edition, Pearson Education,

March, 2013.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, "Network Security", Prentice Hall of India, 2002.

Reference Book(s):

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Man Young Rhee, "Internet Security: Cryptographic Principles", "Algorithms and Protocols", Wiley Publications, 2003.
3. Charles P Fleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
5. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security, Second Edition, Private Communication in Public World", PHI, 2002.
6. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dreamtech India Pvt Ltd, 2003.
7. Douglas R Simson "Cryptography – Theory and practice", First Edition, CRC Press, 1995.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understand the concepts in Number Theory - K1
CO2: Understand the basics of Cryptography - K2
CO3: Understand Hash Functions and Cryptography - K3
CO4: Understand Security Procedure and System Security - K3
CO5: Understand the various Security Services - K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	M	M	S	S	M
CO2	S	S	M	S	M	S	M	S	S	S
CO3	S	S	S	S	M	M	M	S	M	M
CO4	S	S	S	S	S	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAT312	CHOICE -II	L	T	P	C
ELECTIVE -I		BIG DATA ANALYTICS	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

OBJECTIVES

1	To understand and the basic concepts of Big Data
2	To understand about analytics and the purpose of it
3	To understand the Big Data Technologies.
4	To develop the critical thinking and analytical approach by using Hadoop.

UNIT I: Introduction to Big Data

Introduction- Types of Digital Data: Classification of Digita Data, Introduction to Big Data: Characteristics of data - Evolution of Big data - Challenges of Big data - Other Characteristics of Data Which are not Definitional Traits of Big Data-Why Big Data? – Are we Just an Information Consumer or Do we also produce Information?-Traditional Business Intelligence (BI) versus Big Data – A Typical Data Warehouse Environment – A Typical Hadoop Environment – What is New Today? – What is changing in the Realms of BigData?

UNIT – II : Analytics Basics:

Big Data Analytics: Where do we Begin? – What is Big Data Analytics? – What Big Data Analytics Isn't? – Why this Sudden Hype Around Big Data Analytics? Classification of Analytics – Greatest Challenges that Prevent Business from capitalizing on Big Data – Top Challenges Facing Big Data – why is Big Data Analytics Important? – What kind of Technologies are we looking Toward to Help Meet the Challenges Posed by Big Data? – Data Science – Data Scientist…Your New Best Friend – Terminologies Used in Big Data Environments – Basically available Soft State Eventual Consistency (BASE) – Few Top Analytics Tools

UNIT – III: Big Data Technologies:

The Big Data Technology Landscape: NoSQL (Not Only SQL) - Hadoop, Introduction to Hadoop: Introducing Hadoop – Why Hadoop? – Why not RDBMS? –RDBMS versus Hadoop – Distributed Computing Challenges – History of Hadoop – Hadoop Overview–Use Case of Hadoop – Hadoop Distributors – HDFS (Hadoop Distributed File System) Processing Data with Hadoop – Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator) – Interacting with Hadoop Ecosystem.

UNIT – IV: Introduction to MAPREDUCE Programming

Introduction – Mapper – Reducer –Combiner – Partitioner – Searching – Sorting – Compression, Introduction to Hive: What is Hive? – Hive Architecture – Hive Data Types – Hive File Format – Hive Query Language (HQL) –RC File Implementation – SerDe – User – Defined Function (UDF).

UNIT – V: Analytical Algorithms

Analytical Algorithms: Introduction to Machine Learning – Machine Learning Algorithms.

TEXT BOOKS:

1. Seeme Acharya, and Subhashini Chellappan, "Big Data and Analytics", Wiley India Pvt. Ltd., First Edition-2015.

REFERENCE BOOKS:

1. Nathan Marz, and James Warren, "Big Data – Principles and best practices of scalable real–time data systems", Manning Publication cp., USA-2015.
2. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications", Wiley Indi a Pvt. Ltd - 2015.
3. Jared Deamn,"Big Data, Data Mining and Machine Learning" ,Willey India Pvt. Ltd, 2015.

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Describe the basics of Big Data, Types of Data and Data Warehouse Environment - K1
CO2: Understand the Data Analytics, Evolution, Importance, Tools, Technology and Data Science - K3
CO3: Analyze the technologies and comparison of No SQL, RDMS, Hadoop, and YARN - K2
CO4: Analyze the working methodology of Map Reduce and Hive Query Language - K4
CO5: Implement the Machine Learning Algorithms - K4

Mapping Of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	M	M	S	S	M
CO2	S	S	M	S	M	M	M	S	S	S
CO3	S	S	S	S	M	M	M	S	M	S
CO4	S	S	S	S	M	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAE313	CHOICE -III	L	T	P	C
ELECTIVE - I		OPERATIONS RESEARCH	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives

1	To understand the mathematical tools that are needed to solve optimization problems.
2	To provide Basic skills and knowledge of operations research and its application
3	To apply the techniques used in operations research to solve real life problem
4	Able to develop operational research models from the description of the real-world systems.

Unit I: Introduction

Development of OR- Definition OR- General methods for solving OR models –Phases of OR study – tools, techniques and methods – scientific methods in OR .

Unit – II : LPP

Linear Programming Problem – Mathematical formation of LPP – Stack and surplus variables – graphical solution of LPP

Unit – III:

Simplex method – Computational procedure –Two phase method – Duality in LPP

Unit – IV:

Mathematical Formulation of transportation problem – optimal solution of T.P – Methods for obtaining an initial feasible solution – Optimal solution – Handling Degeneracy in T.P

Unit – V:

Mathematical Formulation of Assignment problem – Solution to assignment problems – optimal solution of assignment problem – Unbalanced Assignment solution PERT and CPM – Events – Time Estimate – Floats – Critical path, Probability of Meeting Deadline – Project Cost

Text Books:

1. S.D.Sharma (Kedarnath Ramanath & COBOL), Operation Research, 2005.
2. G. Hadley: Linear Programming. Narosa, Reprint, 2002.
3. G. Hadley: Linear Algebra, Narosa, Reprint, 2002.
4. Hamdy A. Taha: Operations Research-An Introduction, Prentice Hall, 9th Edition, 2010.

Reference Books:

1. A. Ravindran, D. T. Phillips and James J. Solberg: Operations Research- Principles and Practice, John Wiley & Sons, 2005.
2. F.S. Hillier. G.J. Lieberman: Introduction to Operations Research- Concepts and Cases, 9th Edition, Tata Mc-Graw Hill, 2010.
3. Wayne L Winston ,Operations Research: Applications and Algorithms, Indian University, 4th edition, 2004

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Solve optimization problems using mathematical tools - K2, K3
CO2: Solve transportation and assignment problems - K2, K3
CO3: Apply integer programming and linear programming to solve real life applications - K2, K3

CO4: Design simple operation research models to improve decision making - K2, K3
CO5: Gain more knowledge about transportation problem. - K2, K3, K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	M	M	M	M	S	S	M
CO2	S	S	M	S	M	S	M	S	S	S
CO3	S	S	M	M	M	S	M	S	M	S
CO4	M	S	M	S	M	S	M	S	S	S
CO5	S	M	S	S	M	M	M	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks - 2 marks
M- Moderately Correlating - 1 mark

SEMESTER – IV

COURSE CODE	P21CAE421	CHOICE - I	L	T	P	C
ELECTIVE - II		ARTIFICIAL INTELLIGENCE	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives

1	To introduce the basic concepts of AI techniques.
2	To familiarize the types of search methods and apply those methods on raw data.
3	To identify and address predicate logic in problem solving
4	Able to understand the basic concepts of realities

Unit I: Introduction

Problem solving and AI – Puzzles and Games – Problem States and operators – Heuristic programming – state space representations – state descriptions – graph notations – nondeterministic programs.

Unit – II : Problem solving Methods

State space search methods – breadth first and dept h first search – heuristic – admissibility – optimality of algorithms – performance measures – problem reduction representations – AND/OR graphs and higher level state space. Problem reduction search methods – cost of solution trees – ordered search – alpha beta and minimum procedure – theorem proving in predicate calculus – syntax, semantics, Herbrand universe: variables, qualifiers, unification, resolvents.

Unit – III: Predicate Calculus and Expert Systems

Predicate calculus in problem solving – answer extraction process – resolution – Automatic program writing – predicate calculus – proof finding methods. Expert systems: Expert systems and conventional programs – expert system organization – Knowledge engineering: knowledge representation techniques – knowledge acquisition – acquiring knowledge from experts – automating knowledge acquisition –Building an expert system – difficulties in developing an expert system.

Unit – IV: Introduction to Augmented Reality

Introduction to Augmented Reality- Introduction to Augmented Reality (AR), Virtual Reality (VR), eXtended Reality (XR) - Introduction to Unity3D and Content Generation Tools - History, evolution and market impact - Sample applications of AR, VR, XR: Presentation

Unit – V: Virtual Reality and Virtual Environments

Virtual Reality and Virtual Environments: Introduction – Computer Graphics – Real-time computer Graphics – Flight Simulation – Virtual Environment – Benefits of Virtual Reality – Historical Development of VR: Scientific Landmarks.

Text Books:

1. E Charnail, CK Reiesbeck and D V Medermett, “Artificial Intelligence Programming”, Lawrence Erlbaum Associates, N J, 198 0
2. N J Nilson, “Principles of Artificial Intelligence” , Tiega Press, Polo Alto, 2002
3. Elain Rich and Kevin Knight, “Artificial Intelligence”, McGraw Hill, 1991
4. Donald A Waterman, “A Guide to Expert Systems”, Tech knowledge series in knowledge engineering, 1986

Reference Books:

1. Erin Pangilinan, Steve Lukas, et al. _Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing', Apr 14, 2019
2. John Vince, "Virtual Reality Systems", Pearson Education Asia, 2001

Course Outcomes:

After successful completion of the course, Student shall be able to:

CO1: Understands the problem solving techniques in AI. - K2, K5
CO2: Evaluate different searching methods. - K5
CO3: Understands the predicate calculus in problem solving. - K4
CO4: Design and implement virtual realities. - K3
CO5: Evaluate the performance of AR and VR environment. - K4,K5

Mapping of COs with POs and PSOs:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	M	S	M	M	M	S
CO2	M	S	S	M	M	M	M	S	M	M
CO3	M	M	S	S	S	M	S	M	M	S
CO4	S	M	S	M	M	S	M	M	M	S
CO5	M	M	S	S	S	M	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAE422	CHOICE -II	L	T	P	C
ELECTIVE - III		INTERNET OF THINGS	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives:

1	In order to gain knowledge on bases of Internet of Things (IoT)
2	To gain knowledge of IoT Architecture, and the Protocols related to IoT
3	To understand the concept of the Web of Thing
4	To understand the relationship between the IoT and WoT.

Unit I: Introduction

Internet of Things - Physical Design- Logical Design- IoT Enabling Technologies - IoT Levels and Deployment Templates - Domain Specific IoTs - IoT and M2M - IoT System Management with NETCONF-YANG- IoT Platforms Design Methodology.

Unit – II : IoT Architecture:

M2M high-level ETSI architecture - IETF architecture for IoT - OGC architecture - IoT reference model - Domain model - information model - functional model - communication model - IoT reference architecture

Unit – III: IoT Protocols:

Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Unified Data Standards – Protocols – IEEE 802.15.4 – BACNet Protocol – Modbus– Zigbee Architecture – Network layer – 6LowPAN - CoAP – Security

Unit – IV: Web Of Things:

Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence. Cloud of Things: Grid/SOA and Cloud Computing – Cloud Middleware – Cloud Standards – Cloud Providers and Systems – Mobile Cloud Computing – The Cloud of Things Architecture.

Unit – V: Applications:

The Role of the Internet of Things for Increased Autonomy and Agility in Collaborative Production Environments - Resource Management in the Internet of Things: Clustering, Synchronisation and Software Agents. Applications - Smart Grid – Electrical Vehicle Charging.

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, “Internet of Things – A hands-on approach”, Universities Press, 2015.
2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), “Architecting the Internet of Things”, Springer, 2011.

Reference Books:

1. 1. Jan Ho¨ ller, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, "From Machine-to-Machine to the Internet of Things - Introduction to a New Age of Intelligence", Elsevier, 2014.
2. Networks, Crowds, and Markets: Reasoning About a Highly Connected World - David Easley and Jon Kleinberg, Cambridge University Press - 2010.
3. Olivier Hersent, David Boswarthick, Omar Elloumi, “The Internet of Things – Key applications and Protocols”, Wiley, 2012.

Course Outcomes:

After completion of the course, student shall be able to:

CO1: Gain the basic knowledge about IoT and they will be able to use IoT related products in real life. - K2
CO2: helps to rely less on physical resources and started to do their work smarter. - K3
CO3: Able to understand the application areas of IOT - K2
CO4: Able to realize the revolution of Internet in Mobile Devices, Cloud & Sensor Networks - K2
CO5: Able to understand building blocks of Internet of Things and characteristics. - K2, K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	M	M	M	M	M	S	M	M
CO2	S	S	S	M	M	M	S	S	M	S
CO3	S	M	M	S	S	M	S	M	S	S
CO4	S	S	M	S	M	M	S	M	M	M
CO5	M	M	S	S	S	S	M	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAE423	CHOICE -III	L	T	P	C
ELECTIVE - III		DEEP LEARNING	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To teach principles of deep learning to train test sets, analyze variance for Deep learning applications
2.	To build a CNN and apply it to detection and recognition tasks
3.	To impart the fundamental techniques in deep learning and neural networks which enable the development of real time applications
4.	To understand the context of neural networks and deep learning

Unit I: Basics of ML

Applied Math and Machine Learning Basics. Modern Practical Deep Networks-Deep Feedforward Networks

Unit II: Deep Learning Optimization

Regularization for Deep Learning-Optimization for Training Deep Models-Convolutional Network

Unit III: Sequence Modeling

Sequence Modeling: Recurrent and Recursive Nets-Practical Methodology-Applications-Deep Learning Research-Linear Factor Models-Autoencoders-Representation Learning

Unit IV: Probabilistic Models

Structured Probabilistic Models for Deep Learning-Monte Carlo Methods-Confronting the Partition Function Approximate Inference-Deep Generative Models.

Unit V : Frameworks of Deep Learning

Overview to Frameworks-Caffe, Torch7, Theano, cuda-convnet, Ccv, NuPIC, DeepLearning

Text Book:

1. Ian Goodfellow, YoshuaBengio and Aaron Courville, Deep Learning (Adaptive Computation and Machine Learning Series), MIT Press, 2016

Reference Book:

1. Josh Patterson & Adam Gibson, Deep Learning: A Practitioner's Approach, 1st Edition, Kindle Edition, O'Reilly Media Publisher, 2017.

Course Outcomes:

After completing this course, students will be able to:

CO1: Understand the data need of deep learning - K2
CO2: Derive and implement deep learning to your own application. - K3
CO3: Understand the concepts of neural networks and deep learning - K2
CO4: Familiar with the significant technological trends in the rise of deep learning - K2
CO5: Implement and evaluate probabilistic model for deep learning. - K3

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	M	S	M	M	S	M	S	S	M
CO2	M	S	S	S	S	M	S	S	S	M
CO3	S	M	S	M	M	S	M	S	M	M
CO4	S	M	S	M	M	M	M	S	M	M
CO5	M	S	S	S	S	S	S	S	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

NON MAJOR ELECTIVE
OFFERED FOR OTHER DEPARTMENT STUDENTS

COURSE CODE	P21CAN211	CHOICE - I	L	T	P	C
SEMESTER - II		C PROGRAMMING	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To introduce students to the basic knowledge of programming fundamentals of C language.
2.	To impart writing skill of C programming to the students and solving problems.
3.	To impart knowledge on file concepts to use it for data handling.
4.	To impart the knowledge on functions and pointers.

Lab Exercise:

Simple Programs:

1. Finding the largest, smallest among three numbers
2. Generate the Fibonacci sequence

Control Structures:

1. Find whether a number is prime or not
2. Find whether a given number is a perfect or not
3. Find the factorial of a number

Arrays:

1. Program for Sorting
2. Program to search an element
3. Find whether given string is a palindrome or not
4. Perform the addition of two matrices
5. Perform subtraction of two matrices
6. Perform multiplication of two matrices

Functions:

1. Program to apply Recursion
2. Program for Call by Value

Pointers:

1. Program to perform addition
2. Program for swapping two numbers

Structures:

1. Program to print student information using structures
2. Program for Array of structures

File:

1. Program for applying File operations
2. Program to get n numbers and find odd and even numbers using file.

Course Outcomes:

After completing this lab course you will be able to:

CO1 : Understand the logic for a given problem. - K1
CO2 : Recognize and understand the syntax and construction of C programming code. - K2
CO3 : Know the steps involved in compiling, linking and debugging C code. - K3
CO4 : Learn the methods of iteration or looping and branching. - K4
CO5: Make use of different data structures like arrays, pointers, structures and files- K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	S	M	M	S	S	M
CO2	S	S	M	S	M	M	M	S	S	S
CO3	S	S	S	S	M	M	M	S	S	S
CO4	M	S	S	M	S	S	M	S	M	S
CO5	S	M	S	M	M	S	M	M	S	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN212	CHOICE - II	L	T	P	C
SEMESTER - II		PHOTO DESIGNING	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	Demonstrate knowledge of image resolution, image size, and image file format for web, video, and print.
2.	Demonstrate knowledge of design principles, elements, and image composition.
3.	Demonstrate knowledge of typography
4.	Apply principles of composition to produce professional images.

Unit I: Introduction

Getting into Photoshop: Introduction - Best in Photoshop 7.0 - Photoshop Interface-Saving the File-Importing Existing File.

Unit II: Editing and Retouching

Editing and Retouching: Working with Selections-Getting started with the Selection tool-Selection with Rectangle Marquee Tool-Selection with Elliptical Marquee Tool-Moving a Selection-Moving with Keyboard Shortcut-Selection with the Magic Wand-Selection with Lasso Tool-Adding and Subtraction Selection-Selection with the Magnetic Lasso-Transforming a Selection-Combining Selection Tools-Cropping the Completed Image-Quick Mask tool to make Selection-Enabling the Quick Mask Mode-Adjusting Quick Mask Setting-Patch Tool-Paint Tools-Image Color Adjustments.

Unit III: Photoshop

Making Artistic use of Photoshop: Painting Tools-Working with Brushes-Drawing-Eraser Tool-Brushes Palette-Pen Tool-Selecting an Image with Pen Tool-Editing and Cleaning Tools-Clone Stamp Tool-Healing Brush-Image Resizing.

Unit IV: Tools of Photoshop

Building Original Art work: Layers-Creating A Layer -Layer Mask-Transform-Custom shapes - Create Your own Custom shapes.

Unit V: Applications of Photoshop

Transforming Images with Filters: Filters-Text Tool-Text Wrap-Try it.

Text Book:

1. J. Jenitha, A. Diana, “Adobe Photoshop 7.0 - A Novice Guide” ACCA Publication, 2012.

Reference Book:

1. Deke McClelland, Laurie Ulrich Fuller Robert C. Fuller, "Photoshop CS2 Bible", Photoshop® CS2 Bible, Professional Edition, 2005.

2. “Photoshop CS6 in Simple Steps”, Kogent Learning Solutions Inc, Dreamtech Press, 2013.

Course Outcomes:

After completing this course, students will be able to:

CO1: Understand the different dimensions of digital data. - K1
CO2: Analyze, synthesize, and utilize design processes and strategy from concept to delivery to creatively solve communication problems. - K2
CO3: Create communication solutions that address audiences and contexts, by recognizing the human factors that determine design decisions. - K3
CO4: Identify and utilize design history, theory, and criticism from a variety of perspectives, including: art history, communication/information theory, and the social/cultural use of design objects. - K4
CO5: Utilize relevant applications of tools and technology in the creation, reproduction, and distribution of visual messages. - K4

Mapping of COs with POs and PSOs :

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	M	S	M	S	M	M	S	S	M	S
CO2	S	S	S	M	S	S	S	M	S	S
CO3	S	S	M	S	M	S	S	S	M	M
CO4	M	S	M	M	S	M	M	S	S	S
CO5	S	M	M	S	M	M	S	M	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN213	CHOICE - III	L	T	P	C
SEMESTER - II		BIG DATA ANALYTICS	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To study the basic technologies that forms the foundations of Big Data
2.	To understand and apply scaling up machine learning techniques and associated computing techniques and technologies.
3.	To identify the characteristics of datasets and compare the trivial data and big data for various applications.
4.	To recognize and implement various ways of selecting suitable model parameters for different machine learning techniques.

Unit- I: Data Evolution

Data Development Time Line – ICT Advancement-a Perspective – Data Growth-a Perspective – IT Components-Business Process – Landscape-Data to Data Science – Understanding data: Introduction – Type of Data: Numeric – Categorical – Graphical – High Dimensional Data — Data Classification – Hot Data – Cold Data – Warm Data – Thick Data – Thin Data - Classification of digital Data: Structured, Semi-Structured and Un-Structured.

Unit- II: Sources Of Data

Time Series – Transactional Data – Biological Data – Spatial Data – Social Network DataData Evolution – Data Sources Data Science: Data Science-A Discipline – Data Science vs Statistics – Mathematics - Programming Language - Database, - Machine Learning. Data Analytics Relation: Data Science, Analytics, Big Data Analytics.

Unit- III: Data Science Components

Data Engineering, Data Analytics-Methods and Algorithm, Data Visualization Big Data: Introduction To Big Data: - Evolution What is Big Data – Sources of Big Data. Characteristics of Big Data 6Vs – Big data- Challenges of Conventional Systems.

Unit- IV: Data Processing Models

Data Processing Models – Limitation of Conventional Data Processing Approaches – Big Data Myths - Data Discovery-Traditional Approach, Big Data Technology: Big Data Exploration - Data Augmentation – Operational Analysis – 360 View of Customers – Security and Intelligence

Unit- V: Use Cases

Big Data Use cases –Big Data Technology Potentials – Limitations of Big Data and Challenges- Big Data Roles Data Scientist , Data Architect, Data Analyst – Skills – Case Study : Big Data – Customer Insights – Behavioral Analysis – Big Data Applications - Marketing – Retails – Insurance – Risk and Security – Health care.

Text Book:

- V. Bhuvaneswari, T. Devi, “Big Data Analytics: A Practitioner‟s Approach” Sci-Tech Publishers

Chennai 2016.

Reference Books:

1. Han Hu, Yonggang Wen, Tat-Seng, Chua, XuelongLi,"Toward Scalable Systems for Big data Analytic" (2016)
SeemaAcharya, SubhashniChellappan, "Big Data Analytics", Wiley, (2015)

Course Outcomes:

After completing this course, students will be able to:

CO1: Understand the key issues in big data management and its associated applications in intelligent business and scientific computing. - K1

CO2: Acquire fundamental enabling techniques and scalable algorithms like Hadoop, Map Reduce and NO SQL in big data analytics. - K2

CO3: Interpret business models and scientific computing paradigms, and apply software tools for big data analytics. - K2

CO4: Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications. - K3

CO5: Achieve adequate perspectives of big data analytics in various applications like recommender systems, social media applications etc. - K4

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	M	S	S	S	M
CO2	S	M	S	M	S	S	M	S	M	M
CO3	S	M	M	M	S	M	S	M	S	S
CO4	M	S	M	S	M	S	S	S	M	M
CO5	M	S	M	S	M	S	M	S	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN214	CHOICE - IV	L	T	P	C
SEMESTER - II		DIGITAL IMAGE PROCESSING	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:	
1.	To understand the basic fundamental concept of an image
2.	To know the concepts of Image techniques, Sharpe and filtering ideas
3.	To gain the knowledge about image patterns, structures and image compressions
4.	To appreciate the use of current technologies those are specific to image processing systems.

Unit- I: Digital Image Fundamentals

Image formation, Image transforms – Fourier transforms, Walsh, Hadamard, Discrete cosine, Hostelling transforms.

Unit-II: Image Enhancement And Restoration

Histogram modification techniques - Image smoothening – Image sharpening - Image restoration - Degradation model – Noise models- Spatial filtering – Frequency domain filtering

Unit- III: Image compression and segmentation:

Compression Models - Elements of information theory - Error free compression - Image segmentation – Detection of discontinuities - Edge linking and boundary detection – Thresholding – Region based segmentation – Morphology

Unit- IV: Representation and description:

Representation schemes – Boundary descriptors – Regional descriptors –Relational descriptors

Unit- V: Object Recognition And Interpretation

Patterns and pattern classes - Decision - Theoretic methods -Structural methods.

Text Book:

1.Gonzalez, R.C., Woods, R.E., "Digital Image Processing", 2nd Edition, Pearson Education ,2002.

Reference Books:

1.Anil Jain, K., "Fundamentals of Digital image Processing" , Prentice all of India,1989.
2.Sid Ahmed, "Image Processing",McGraw Hill, New York, 1995.

Course Outcomes:

After completing this course, students will be able to:

CO1: To remember the basic image concepts. - K1
CO2: To know the image sharpens enhancement and compression models. - K2
CO3: To apply various image techniques like edge linking and boundary detection. - K3
CO4: To analyze basic requirements of image processing like structure, compression and resolution. - K4
CO5: Understand the role of image segmentation, various color models and color image transformation - K4

Mapping of COs with POs and PSOs :

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S	S	S	S	S	S	S
CO2	M	M	S	M	S	S	M	S	M	S
CO3	S	M	S	M	M	S	S	M	S	S
CO4	S	S	M	S	S	M	S	S	M	M
CO5	S	M	M	M	S	S	M	M	S	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN215	CHOICE - V	L	T	P	C
SEMESTER - II		MOBILE COMPUTING	4	-	-	4
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To learn the basic concepts of Mobile Computing and its Applications.
2.	To provide various emerging technologies in Mobile computing services.
3.	To gain knowledge about GSM, GPRS, CDMA and 3G.
4.	To study the specifications and functionalities of various protocols/standards of mobile networks.

Unit I: Introduction

Mobility of bits and bytes, wireless- The beginning, mobile computing – Networks – Middleware and Gateways – Application and Services – Developing Mobile computing Applications – Security in Mobile Computing.

Unit II: Mobile Computing Architecture

History of Computers – History of Internet – Internet – The ubiquitous network – Architecture for Mobile Computing– Three Tire Architecture - Design consideration for Mobile Computing- Mobile Computing through Internet – Making existing Applications Mobile – Enabled

Unit III: Mobile Communication

Global System For Mobile Communication (GSM): Global system for Mobile Communication- GSM Architecture – GSM entities – Call routing in GSM, PLMN Interface – GSM Address Identifiers – Network aspects in GSM- GSM frequency allocation – Authentication and Security. Short Message Service (SMS) : Mobile Computing over SMS - Short Message Service- Value added services through SMS – Accessing the SMS bearer.

Unit IV: General Packet Radio Service (GPRS)

General Packet Radio Service (GPRS) : Introduction – GPRS and packet data network – GPRS network architecture – GPRS network operations – Data services in GPRS – Applications for GPRS- limitations of GPRS – Billing and Charging in GPRS.Wireless Application Protocol (WAP): Introduction – WAP – MMS- GPRS application

Unit V: CDMA AND 3G

CDMA AND 3G : Introduction – Spread spectrum technology – IS 95- CDMA versus GSM – Wireless data –Third generation network – Application on 3G. WIRELESS LAN : Introduction – Wireless LAN advantages – IEEE 802.11 standards – Wireless LAN architectures – Mobility in Wireless LAN – Deploying Wireless LAN – Mobile Ad-hoc network and sensor network – Wireless LAN Security – WiFi versus 3G.

Text Book:

1.Ashok K Talukder, Roopa R Yavagal, “Mobile Computing”, Tata McGraw Hill Publishing CompanyLtd, 2005.

Reference Books:

1. Jochen Schiller, (2004), “Mobile Communications”, Second Edition, Addision Wesely

Publications.
2. UWE Hansmann, LotherMerk, Martin.S, (2006), "Principles of Mobile Computing", Second Edition, Springer publications.
3. Jeyasri Arokiamary,(2005), "Mobile Communications", First Edition, Anuradha Agencies.

Course Outcomes :

After completing this course, students will be able to:

CO1: To member the concept of Wireless LANs, PAN, Mobile Networks - K1
CO2: To understand positioning techniques of location-based services and applications - K2
CO3: To apply all techniques used in the GSM and GPRS - K3
CO4: To analyze CDMA and wireless LANS. - K4
CO5: To design a system, component or process as per needs and specifications - K3

Mapping of COs with POs and PSOs :

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	S	S	M	S	M
CO2	M	S	S	M	S	S	M	S	S	S
CO3	S	S	M	S	S	M	S	M	S	S
CO4	M	S	M	S	S	S	S	S	S	M
CO5	S	M	M	M	S	S	M	S	M	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN216	CHOICE - VI	L	T	P	C
SEMESTER - II		DATA COMMUNICATION AND NETWORKING	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To understand the basic concepts of data communication, layered model, protocols and interworking between computer networks and switching components in telecommunication systems.
2.	To be familiar with the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks.
3.	Introduce the student to a network routing for IP networks and how a collision occurs and how to solve it and how a frame is created and character count of each frame.
4.	An overview of security issues related to data communication in networks.

Unit I: **Introduction**

Introduction To Data Communications And Networking: Introduction-Fundamental Concepts - Data Communication – Protocols – Standards – Signal Propagation – Analog and Digital Signals. Information Encoding: Representing Different Symbols – Minimizing Errors - Analog and Digital Transmission Methods – Modes of Data Transmission and Multiplexing. Transmission Errors: Detection and Correction.

Unit II: Transmission Media

Transmission Media: Guided Media - Unguided Media. Network Topologies: Mesh, Star, Tree, Ring, Bus – Switching: Circuit switching, Message switching, Packet switching. Routing Algorithms: Routers and Routing – Factors affecting Routing Algorithms – Routing Algorithms – Approaches to Routing – Network Protocols and OSI Model

Unit III: LAN

Local Area Networks (LAN), Metropolitan Area Networks (MAN) and Wide Area Networks (WAN): LAN– Ethernet – MAN – Switched Multimegabit Data Services (SMDS) - WAN – WAN Architecture - WAN Transmission Mechanism - WAN Addressing – Packet Forwarding – Aloha - Integrated Services Digital Network (ISDN) – X.25 Protocol – Frame Relay.

Unit IV: ATM

Asynchronous Transfer Mode (ATM) - Internetworking Concepts, Devices, Internet Basics, History and Architecture – An Introduction to TCP / IP, IP, ARP, RARP, ICMP.

Unit V: Transmission Control Protocol

Features of TCP, Relationship between TCP and IP *, Ports and Sockets, TCP connections, What makes TCP Reliable, TCP Packet Format – User Datagram Protocol (UDP): UDP Packet, Difference between UDP and TCP – Domain Name System (DNS) – Electronic Mail (Email) – File Transfer Protocol (FTP).

Text Book:

1. Achyut S. Godbole, (2007), “Data Communications and Networks”, Ninth reprint, Tata McGraw- Hill Publishing Company Limited.

Reference Books:

1. Behrouz A. Forouzan, (2007), “Data Communications and Networking”, Second Edition Update, Nineteenth reprint, Tata McGraw-Hill Publishing Company Limited.

2. Andrew S. Tanenbaum, (2001), "Computer Networks", Third Edition, Prentice Hall

Course Outcomes :

After completing this course, students will be able to:

CO1: Understand the basics of data communication, networking, internet and their importance. - K1
CO2: Understand Internet structure and can see how standard problems are solved and the use of cryptography and network security - K2
CO3: Apply knowledge of different techniques of error detection and correction to detect and solve error bit during data transmission. - K3
CO4: Identify the basic security threats of a network - K4
CO5: Analyze TCP/IP and their protocols. - K4

Mapping of COs with POs and PSOs :

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	S	S	M	S	M	S	S	S
CO2	S	S	S	M	S	S	S	M	S	S
CO3	M	S	M	M	S	S	S	S	M	M
CO4	S	S	M	S	S	M	M	S	S	S
CO5	M	S	M	M	S	M	S	M	S	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks
M- Moderately Correlating - 1 mark

COURSE CODE	P21CAN217	CHOICE - VII	L	T	P	C
SEMESTER - II		CLOUD COMPUTING	4	-	-	4
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To understand the basic knowledge about the cloud computing techniques and architecture.
2.	To gain knowledge of cloud services and cloud security.
3.	To be able to understand Cloud Segment, Cloud Deployment Models and key cloud companies.
4.	Identify and define technical challenges for cloud applications and assess their importance.

Unit –I: Introduction

Introduction - cloud computing at a glance – Historical development – Building cloud computing environment.

Unit- II: Parallel and Distributed Computing

Principles of parallel and distributed computing – Eras of computing – parallel Vs distributed computing – Elements of parallel computing – Elements of distributed computing – Technologies for distributed computing.

Unit- III: Architecture of Cloud Computing

Cloud Computing Architecture: Introduction – Cloud reference model – Types of clouds – Organizational aspects.

Unit- IV: Applications of Cloud Computing

Cloud Applications: Scientific Applications: Healthcare –Business and Consumer Applications: CRM and ERP – Media Applications – Multiplayer Online gaming

Unit- V:Cloud Security

Cloud Security – Cloud Computing Concept – Cloud Risk – Cloud Security Tools and Techniques – Data Production in Cloud – Cloud Storage – Data Loss Prevention – Cloud Application Security – Security Assertion Markup Language.

Text Books:

1.Rajkumar Buyya, Christian vecchiola , Thamarai selvi, (2013), “Mastering Cloud computing”, Mc Gram Hill Publication. (UNIT – I to UNIT –IV)

2.Charles P.Pfleeger, Shari Lawrence Pfleeger, Deven N.Shan, (2007), “Security in Computing”, Fourth Edition, Prentice Hall Publication. (UNIT –V)

Reference Book:

1. Judith Hurwitz, Robin Bloon, (2009), “Cloud Computing for Dummies”

Course Outcomes:

After completing this course, students will be able to:

CO1: Identify the architecture and infrastructure of cloud computing including SaaS, PaaS, IaaS, public cloud, private cloud, and hybrid cloud. - K1

CO2: Understand the core issues of cloud computing, security, privacy, and interoperability. - K2

CO3: Apply the appropriate technologies and approaches for the related issues in Cloud Computing. - K3

CO4: Analyze the suitable cloud computing solutions and recommendations according to the applications used. - K4

CO5: Learn the Concept of Cloud Infrastructure Model. - K1

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	S	M	S	M	S
CO2	S	S	M	S	S	M	M	S	S	S
CO3	S	M	M	M	S	M	M	S	M	S
CO4	M	M	S	S	M	S	M	M	S	S
CO5	S	S	M	M	M	S	M	S	M	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

VALUE ADDED PROGRAMME

COURSE CODE	P21CAV11	OBJECT ORITENTED PROGRAMMING USING C++	L	T	P	C
SEMESTER - I			2	-	-	2
Cognitive Level	K1: Recall	K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	To understand how C++ improves C with object-oriented features.
2.	To learn how to write inline functions for efficiency and performance
3.	To learn the syntax and semantics of the C++ programming language.
4.	To learn how to design C++ classes for code reuse.

Unit I: **Principles of Object Oriented Programming, Beginning with C++**

Basic concepts of procedure-oriented and object oriented programming - Benefits and Applications of OOP - Structure of C++ program with simple C++ program - C++ data types, Symbolic constants and Reference by variables - Operators in C++ and Operator precedence - Control structures - Function in C++ , the main function, Function prototyping - Call by reference & Return by reference - Inline function & Default arguments - Function overloading.

Unit – II : Classes and Objects

Specifying a class- Defining member functions - Private member functions & Nesting of member functions - Arrays within a class - Memory allocation for objects - Static data members & Static member functions - Arrays of objects - Objects as function arguments - Friendly functions - Returning Objects.

Unit – III: Constructers and Destructors, Overloading

Constructors - Default constructor, Parameterized constructor &Copy constructor - Multiple constructors, Constructors with default arguments & Dynamic constructor – Destructors - Operator overloading, Unary and Binary operator overloading - Overloading using friends - Rules for overloading - Type conversion.

Unit – IV: Inheritance

Inheritance - Defining derived classes & Visibility modes - Single, Multilevel, Multiple, Hierarchical and Hybrid inheritance - Virtual base classes & Abstract classes - Constructors in derived classes - Nesting of classes.

Unit – V: Pointers, Virtual Functions and Polymorphism, Working with Files

Pointers - Pointers to objects & this pointer - Pointers to derived classes - Virtual functions & Pure virtual functions - File Stream classes - Opening and closing a file- File opening modes - File pointers and their manipulations - Sequential input and output operations.

Text Books:

1. E. Balagurusamy – Object Oriented Programming with C++, Fifth edition, Tata McGraw Education Hill, 2011.
2. Ashok N. Kamthane, Object oriented Programming with ANSI & Turbo C++, First Edition, Pearson India, 2006.

Reference Books

1. Robert Lafore, Object Oriented Programming in Turbo C++, First Edition, Galgotia Publications, 2002

2. D.Ravichandran, Programming with C++, Second edition, Tata McGraw- Hill, 2002

Course Outcomes:

After completing this course, students will be able to:

CO1: Understand the difference between the top-down and bottom-up approach - K2
CO2: Describe the object-oriented programming approach in connection with C++ - K2
CO3: Apply the concepts of object-oriented programming - K3
CO4: Illustrate the process of data file manipulations using C+ - K1
CO5: Apply virtual and pure virtual function & complex programming situations - K3

Mapping of COs with POs and PSOs :

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	S	S	M	S	S	S
CO2	S	S	M	S	S	S	M	S	S	S
CO3	S	M	M	M	S	S	M	S	M	S
CO4	M	S	M	S	S	S	M	S	S	S
CO5	S	M	S	S	S	S	M	M	S	S

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

COURSE CODE	P21CAV42	BIG DATA ANALYTICS LAB	L	T	P	C
SEMESTER - IV			2	-	-	2
Cognitive Level		K1: Recall K2: Understand K3: Apply K4: Analyze				

Objectives:

1.	Conceptualization and Summarization of big data
2.	Trivial data versus big data
3.	Big data computing technologies
4.	Machine learning techniques and Scaling up machine learning approaches

List of Programs:

1. Installation of Hadoop:
   Three modes of Installation
   Stand Alone Mode:
   Pseudo Distributed Mode:
   Fully Distributed Mode
2. Weather Report POC-Map Reduce Program to analyse time – temperature statistics and generate report with max/min temperature.

Problem Statement:

1. The system receives temperatures of various cities (Austin, Boston, etc) of USA captured at regular intervals of time on each day in an input file.
2. System will process the input data file and generates a report with Maximum and Minimum temperatures of each day along with time.
3. Generatesaseparateoutputreportforeachcity.Ex:Austin-r-00000 Boston-r-00000 Newjersy-r-00000 Baltimore-r-00000 California-r-00000 Newyork-r-00000

3. Implementing Matrix Multiplication with Hadoop MapReduce
4. Pig Latin Scripts to sort, group, join, project, and filter our data.
5. Hive Databases, Tables, Views, Functions and Indexes
6. Hive Functions:

a. Built-in Functions
   1. Collection Functions
   2. Date Functions
   3. Mathematical Functions
   4. Conditional Functions
   5. String Functions
   6. Miscellaneous Functions

b. UDFs (User Defined Function)

Course outcomes:

After completing this lab course, students will be able to:

CO1: Ability to identify the characteristics of datasets and compare the trivial data and big data for various applications. - K3

CO2: Ability to select and implement machine learning techniques and computing environment that are suitable for the applications under consideration. - K2

CO3*:* Ability to solve problems associated with batch learning and online learning, and the big data characteristics such as high dimensionality, dynamically growing data and in particular scalability issues. - K4

CO4*:* Ability to understand and apply scaling up machine learning techniques and associated computing techniques and technologies. - K3

CO5: Ability to recognize and implement various ways of selecting suitable model parameters for different machine learning techniques. - K3

Mapping of COs with POs and PSOs:

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2	PSO3	PSO4
CO1	S	S	M	S	M	M	M	S	S	S
CO2	S	S	M	S	M	M	M	S	S	M
CO3	S	S	S	S	M	M	M	S	M	S
CO4	S	S	S	S	M	S	M	S	M	S
CO5	S	S	M	S	S	S	M	S	M	M

S – Strongly Correlating - 3 marks M- Moderately Correlating - 2 marks M- Moderately Correlating - 1 mark

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