Program Name: Master of Computer Applications
Discipline   : Computer Applications
(For those who join in June 2022 and after)

1) Course Objectives :

MCA is a course exclusively designed to meet the IT requirements of IT Trained Students for various organizations. The well balanced course significantly emphasizes on planning, designing and building of complex commercial application software and system software. The course also places equal importance on the functional knowledge in various areas. A two years full-time MCA course is not just a postgraduate course; it is also a complete professional grooming for students for a successful career in the IT Industry.

2) Eligibility for admission :

A pass in a recognized Bachelor's degree of minimum 3 years duration in **BCA, Bachelor Degree in Computer Science Engineering or equivalent degree or passed B.Sc / B.Com / B.A with Mathematics at 10 + 2 level or at Graduation level** and obtained atleast 50% marks(45% marks in case of candidates belonging to reserved category) in the qualifying degree examinations.

3) Duration of the Course : 2 years

Course Scheme:

SEMESTER I

Part	Course Title	Hours	Credit	Marks			Course Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged. (If revised % of change)
				I	E	Total			
Core 1	Digital Principles and Computer Organization	4	4	40	60	100	**P22CAC11**/ P20CAC11	Employability	No Change
Core 2	Java Programming	4	4	40	60	100	**P22CAC12**	Skill Development	5% Revised
Core 3	Open Source Technology	4	4	40	60	100	**P22CAC13**/ P20CAC13	Skill Development	No Change
Core 4	Software Engineering	4	4	40	60	100	**P22CAC14**/ P20CAC14	Employability	Hours and Credit changed
Elective I	Operating System / Computer Graphics / Distributed Operating Systems	5	5	40	60	100	**P22CAE11/ P22CAE12/ P22CAE13** P20CAE12/ P20CAE13	Employability/ Employability/ Employability	40% Revised No Change No Change
Core 5 – Lab	Lab: Java Programming	5	3	40	60	100	**P22CAP11**/ P20CAP11	Skill Development	No Change
Core 6 – Lab	Lab: Open Source Programming	4	2	40	60	100	**P22CAP12**	Skill Development	Hours and Credit changed 10% Revised
		30	**26**	280	420	700			

SEMESTER II

Part	Course Title	Hours	Credit	Marks			Course code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged. (If revised % of change)
				I	E	Total			
Core 7	Python Programming	4	4	40	60	100	**P22CAC21**	Skill Development	5% Revised
Core 8	Relational Database Management System	4	4	40	60	100	**P22CAC22**	Employability	5% Revised

Core 9	Data Communications and Networks	4	4	40	60	100	**P22CAC23/** P20CAC23	Employability	Hours and Credit changed
Elective II	Mobile Computing/ Data Mining/ Cloud Computing	5	5	40	60	100	**P22CAE21/ P22CAE22/ P22CAE23** P20CAE21/ P20CAE22	Employability/ Employability/ Skill Development	No Change No Change 20% Revised
NME	Internet and Web Designing	4	4	40	60	100	**P22CAN21**	Skill Development	10% Revised
Core 10 – Lab	Lab: Python Programming	4	2	40	60	100	**P22CAP21**	Skill Development	Hours and Credit changed
Core 11 – Lab	Lab: Relational Database Management System	5	3	40	60	100	**P22CAP22**	Skill Development	20% Revised
		30	**26**	280	420	700			

SEMESTER III

S.No	Part	Course Code	Course Title	Hours	Credit	Marks I	Marks E	Marks Total
1	Core 12		Cryptography and Network Security	4	4	40	60	100
2	Core 13		Principles of Compiler Design	4	4	40	60	100
3	Core 14		Artificial Intelligence and Applications	4	4	40	60	100
4	Core 15		Internet of Things	4	4	40	60	100
5	Elective III		Software Project Management / Theory of Computation /Soft Computing	5	5	40	60	100
6	Core 16 – Lab		Android Programming Lab	5	3	40	60	100
7	Core 17 – Lab		Dot Net Programming Lab	4	2	40	60	100
				30	26	280	420	700

SEMESTER IV

S.No.	Part	Course Code	Course Title	Hours	Credit	Marks I	Marks E	Marks Total
1	Core 18		R Programming	4	4	40	60	100
2	Core 19 - Lab		Angular Lab	4	2	40	60	100
3	Project and Viva-Voce		Project and Viva-Voce	-	6	100	100	200
				8	12	180	220	400

SEMESTER - I

Course Title: Digital Principles And Computer Organization	Total Hours: 60 Hours
Course Code: **P22CAC11**/ P20CAC11	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	To obtain basic idea about digital logic design
CO2	To obtain knowledge arithmetic and combinational circuits.
CO3	To understand the basics of a computer
CO4	To understand the architecture of computer.
CO5	To obtain in-depth knowledge of micro programming.

Unit I   **12 Hours**
Binary Systems - Digital Computers and Digital Systems; Binary Numbers; Number Base conversion; Octal and Hexadecimal numbers; Binary Codes.
Boolean Algebra and Logic Gates - Basic definitions; Axiomatic definition of Boolean Algebra; Basic theorems and properties of Boolean Algebra; Boolean functions; Canonical and standard forms; Other logic operations; Digital logic gates; IC digital logic families.

Unit II   **12 Hours**
Simplification of Boolean Function - The map method;Two and Three variable maps;Four variable maps; Five and Six variable maps; Don't-care conditions.
Combinational logic - Introduction; Design procedure; Adders;Subtractors.
Combinational logic with MSI and LSI - Decoders; Multiplexers.
Sequential Logic - Introduction; Flip-Flops; Triggering of Flip-Flop.

Unit III   **12 Hours**
Basic structure of Computers - Computer types; Functional units; Basic operational concepts; Bus structures; Software; Historical Perspective.
Machine instructions and programs - Memory location and addresses; Memory operations; Instructions and Instruction Sequencing; Addressing modes; Assembly language; Basic Input / Output Operations.

Unit IV   **12 Hours**
Input / output organization - Accessing I / O devices; Interrupts; Direct Memory Access (DMA); Buses; Interface Circuits.
The memory system - Read Only Memories; Cache memories.

Unit V   **12 Hours**
Basic Processing Unit - Some fundamental concepts; Execution of a complete instruction; Multiple-Bus organisation; Hardwired control; Micro Programmed Control.
Pipelining - Basic concepts;Data Hazards; Instruction Hazards.

Text Books
1) M.Morris Mano, "Digital Logic and Computer Design", Pearson Prentice Hall, Thirteenth Impression, 2011.

Unit I	Chapter 1 (1.1 to 1.4, 1.6)
	Chapter 2 (2.1 to 2.8)
Unit II	Chapter 3 (3.1 to 3.4, 3.8)
	Chapter4 (4.1 to 4.4)
	Chapter5 (5.5, 5.6)
	Chapter6 (6.1 to 6.3)

2) Carl Hamacher, ZvonkoVranesic, Safwatzaky, "Computer Organization", Tata McGraw Hill Education Private Limited, Fifth Edition, 2012.

Unit III	Chapter1(1.1 to 1.5, 1.8)
	Chapter2(2.2 to 2.7)
Unit IV	Chapter4(4.1, 4.2, 4.4 to 4.6)
	Chapter5 (5.3, 5.5)
Unit V	Chapter7(7.1 to 7.5)
	Chapter8(8.1 to 8.3)

Reference Books

1) Donald P.Leach, Albert Paul Malvino, Digital Principles and Applications, TMH 2001.
2) S.Salivaganan, S.Arivalagan, Digital Circuits and Design, Vikas Publishing House Pvt Ltd, Third Edition – 2007
3) M.Morris Mano, Computer System Architecture,Pearson Prentice Hall, Third Edition, 2006.

e – Resources

1. https://www.youtube.com/watch?v=3zvINQUdUns&t=124s
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_logic_gates.htm
3. https://www.javatpoint.com/digital-electronics
4. https://docs.google.com/file/d/0B8-drkZsESDnN2NmYTQxYjQtYTMwZi00N2IzLTkxNjgtZjI1NTZiN2FjNDli/edit?resourcekey=0-Yk8bAsCt9I5epBNFTG8KMQ
5. https://www.javatpoint.com/computer-organization-and-architecture-tutorial
6. https://www.geeksforgeeks.org/computer-organization-and-architecture-tutorials/
7. https://nptel.ac.in/courses/106/106/106106092/

Course Title : Java Programming	Total Hours :60 Hours
Course Code : P22CAC12	Total Credits : 4

Course Outcomes

COs	CO Statement
CO1	Demonstrate the principles of object oriented programming concepts and solve simple problems using the fundamental syntax and semantics of the java programming language
CO2	Understand the behavior of primitive data types, operators and decision & iteration control structures.
CO3	Demonstrate the ability to use class and its types, constructor, overloading, overriding and arrays in a Java program.
CO4	Understand the concept of package, interface, multithreading, exception handling.

CO5	Acquire the knowledge about applet class and creating the applet animation programs.	

Unit I   **12 Hours**
An Overview of Java - Object Oriented Programming; A First Simple Program, A Second Short program; Two Control statements, Using Blocks of code, Lexical issues, The Java class libraries.
Data types, Variables and Arrays -Java is strongly typed language,– The Primitive types, Integers, Floating point types, Characters, Booleans, A closer look at Literals, Variables,Type conversion and Casting, Automatic type promotion in expressions, Arrays.

Unit II   **12 Hours**
Operators -Arithmetic operators, The Bitwise operators, Relational Operators, Boolean logical operators, The Assignment operator, The ? operator, Operator precedence, Using parentheses.
Control Statements -Java's selection statements, Iteration statements, Jump statements.
Introducing Classes -Class fundamentals, Declaring Objects, Assigning Object reference variables, Introducing methods, Constructors, The this keyword, Garbage collection, The finalize( ) method.
A closer look at methods and classes -Overloading methods, Using object as parameters, A closer look at argument passing, Returning objects, Recursion, Introducing access control, Understanding static, Introducing final, Arrays Revisited; Introducing nested and inner classes, Exploring the String classes; Using command line arguments.

Unit III   **12 Hours**
Inheritance -Inheritance basics, Using super, Creating multilevel hierarchy, When constructors are executed, Method overriding, Dynamic method dispatch, Using abstract classes, Using final with inheritance, The Object class.
Packages and Interfaces –Packages, Access Protection, Importing packages, Interfaces.

Unit IV   **12 Hours**
Exception Handling -Exception handling fundamentals, Exception types, Uncaught exceptions, Using try and catch, Multiple catch clauses, Nested try statements, throw, throws, finally, Java's Built-in Exceptions, Creating your own Exception subclasses, Chained Exceptions, Tree Recently added Exceptions features; Using Exceptions.**String Handling** -The String constructors, String length, Special String operations, Character Extraction, String Comparison, Searching Strings, Modifying a String, Data Conversion using valueOf( ), Changing the case of characters within a String, Joining strings; Additional string methods; String Buffer.

Unit V   **12 Hours**
Multithreaded programming - The Java Thread model, The Main Thread, Creating a Thread, Creating Multiple Threads, Using isAlive( ) and join( ), Thread priorities, Synchronization, Inter thread communication, Suspending, Resuming and Stopping Threads, Obtaining A Thread's State; Using Multithreading.
The Applet Class–Two types of Applets;Applet basics, Applet Architecture, An Applet skeleton, Simple Applet Display methods, Requesting Repainting, Using the status window, The HTML APPLET tag, Passing parameters to Applets, getDocumentBase( ) and getCodeBase( ), AppletContext and showDocument( ), The AudioClip Interface, The AppletStub Interface, Outputting to the console.

Text Book
Herbert Schildt, "The Complete Reference Java2*", Tata McGraw Hill edition, Ninth edition, 2015.

Unit I	Chapter2 (Pages 17 to 34)
	Chapter3 (Pages 35 to 58)
Unit II	Chapter4 (Pages 61 to 79)
	Chapter5 (Pages 81 to 108)
	Chapter6 (Pages 109 to 126)
	Chapter7 (Pages 129 to 154)
Unit III	Chapter8 (Pages 161 to 186)
	Chapter9 (Pages 187 to 207)
Unit IV	Chapter10 (Pages 213 to 232)
	Chapter16 (Pages 413 to 438)
Unit V	Chapter 11 (Pages 233 to 261)
	Chapter23 (Pages 747 to 767)

Reference Books
1. Steven Holzner et al, "Java 2 Programming Black book", Dreamtech press, 2008.
2. Rajkumar Buyya, S.Thamarai Selvi, Xingchen Chu, "Object Oriented Programming With Java", Tata McGraw Hill, 2009.
3. Dr. G.T. Thampi, "Object Oriented Programming in Java", DreamTech Press, 2009.

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1. https://www.w3schools.com/java/
2. https://www.tutorialspoint.com/java/index.htm
3. https://www.geeksforgeeks.org/types-references-java/
4. https://beginnersbook.com/java-tutorial-for-beginners-with-examples/
5. https://inst.eecs.berkeley.edu/~cs61b/fa14/book1/java.pdf
6. http://www.sietk.org/downloads/javabook.pdf

Course Title: Open Source Technology	Total Hours: 60 Hours
Course Code: P22CAC13/ P20CAC13	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	Learn the basic concepts in PHP and gain knowledge of dynamic website.
CO2	Learn arrays, strings and date functions in PHP.
CO3	Learn different types of functions and its uses in PHP
CO4	Learn the basic design of database, table creation and modifications in MySQL
CO5	Learn to build Dynamic web site using PHP and Database connectivity.

Unit I   **12 Hours**
PHP Crash Course- Before you begin; Creating a Sample Application; Embedded PHP inHTML; Adding Dynamic Content; Accessing form variables;Understanding identifiers; Examining Variable types; Declaring and using Constants; Understanding Variable Scope;

Using operators; Working out the form totals; Understanding precedence and Associativity– Using variable functions; Making Decisions with Conditionals; Repeating actions throughiteration; Breaking out of a Control Structure or Script; Employing Alternative ControlStructure Syntax.

Unit II   12 Hours
Using Arrays - Array; Numerically indexed arrays; Arrays with different indices; Array operators; Multidimensional Arrays.
String Manipulation and Regular Expressions - Creating a sample application: Smart FormMail; Formatting Strings; Joining and Splitting Strings with String Functions; ComparingStrings.
Managing the Date and Time - Getting the date and Time from PHP; Converting betweenPHP and MySQL Date formats; Calculating Dates in PHP; Calculating Dates in MySQL; Using Microseconds.

Unit III   12 Hours
Reusing Code and Writing Functions - The Advantages of Reusing code; Using require()and include(): Filename extensions and require(); Using require() for website templates;Using Functions in PHP; Defining your own functions; Examining Basic FunctionStructure; Using Parameters; Understanding Scope; Passing by reference versus Passingby value; Using the return Keyword; Implementing Recursion.

Unit IV   12 Hours
Creating Your Web Database - Creating Databases and Users; Setting Up Users andPrivileges; Introducing MySQL's Privilege System; Setting up a user for the web; Usingthe Right Database; Creating Database Tables.
Working with Your MySQL Database–SQL; Inserting Data into the Database; Retrieving Data from Database; Updating Records in the database; Altering Tables after Creation;Deleting Records from the Database; Dropping Tables; Dropping the whole Database.

Unit V   12 Hours
Accessing Your MySQL Database from the web with PHP: How web DatabaseArchitectures work – Querying a Database from the web.
Using Session Control in PHP: Session Control; Understanding Basic sessionFunctionality;Implementing simple sessions; Creating a session Example; ConfiguringSession Control; Implementing Authentication with session.
Interacting with the File System and the Server: Uploading files.

Text Book
1. Luke Welling, Laura Thomson, "PHP and MySQL Web Development", Pearson Education, Fourth Edition(2010).

Unit I	Chapter1 (Page number 13 to 56)
Unit II	Chapter3 (Page number 81 to 88)
	Chapter4 (Page number 107 to 120)
	Chapter21 (Page number 469 to 480)
Unit III	Chapter5 (Page number 133 to 141, 143 to 156)
Unit IV	Chapter9 (Page number 222 to 229)
	Chapter10 (Page number 243 to 264)
Unit V	Chapter11 (Page number 267 to 276)
	Chapter23 (Page number 509 to 517)

Chapter19 (Page number 431 to 438)

Reference Books

1. VikramVaswani, "A Beginner"s Guide PHP", Tata Mcgraw Hill Education Private Limited, 2009.

2. Larry Ullman, "PHP 6 and MySQL 5", Pearson Education, 2008.

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1. https://www.w3schools.com/php/default.asp
2. https://www.php.net/
3. https://www.codecademy.com/catalog/language/php
4. https://www.tutorialspoint.com/php/index.htm
5. https://www.geeksforgeeks.org/php-tutorials/

Title : Software Engineering	Total Hours: 60 Hours
Course Code : **P22CAC14/** P20CAC14	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	Understand and demonstrate basic knowledge in software engineering.
CO2	Understand various life cycle models of software engineering.
CO3	Be familiar with the concepts such as software project management techniques and requirements analysis and specification.
CO4	Learn Virtual Storage Organization and its Management Strategies.
CO5	Apply testing principles on software project and understand the maintenance concepts.

Unit I **12 Hours**

Introduction - Evolution-From an Art form to an Engineering Discipline; Software Development Projects; Emergence of Software Engineering; Computer System Engineering.
Software Life Cycle Models -Waterfall Model and its Extensions; Rapid Application Development (RAD); Agile Development Models; Spiral Model-A Comparison of DifferentLife Cycle Model

Unit II **12 Hours**

Software Project Management -Responsibilities of a Software Project Manager; Project Planning; Metrics for Project Size Estimation; Project Estimation Techniques; Empirical Estimation Techniques; COCOMO.
Requirements Analysis and Specification - Requirements Gathering and Analysis; Software Requirements Specification (SRS); Formal System Specification

Unit III **12 Hours**

Software Design - Overview of the Design Process; Cohesion and Coupling; Layered Arrangement of Modules.
Function-Oriented Software Design -Structured Analysis; Developing the DFD Model of a System; Structured Design.

Unit IV	12 Hours

Object Modelling Using UML -UML Diagrams; Class Diagrams; Interaction Diagrams; Activity Diagrams; State Chart Diagrams.
Software Reuse -Basic Issues in any Reuse Program; A Reuse Approach; Reuse at Organization Level.

Unit V	12 Hours

Coding and Testing –Coding; Code Review; Software Documentation; Testing; Unit Testing; Black-Box Testing; White-Box Testing; Debugging; Integration Testing; System Testing.
Software Maintenance -Characteristics of Software Maintenance; Software Reverse Engineering; Software Maintenance Process Models; Estimation of Maintenance Cost.

Text Book
Rajib Mall, "Fundamentals of Software Engineering", PHI Publication, Fourth Edition, 2016.

Unit I	Chapter 1 (1.1, 1.2, 1.4, 1.6)
	Chapter 2 (2.2 to 2.6)
Unit II	Chapter 3 (3.2 to 3.7)
	Chapter 4 (4.1 to 4.3)
Unit III	Chapter 5 (5.1, 5.3, 5.4)
	Chapter 6 (6.2, 6.3, 6.4)
Unit IV	Chapter 7 (7.3, 7.5, 7.6, 7.7, 7.8)
	Chapter 14 (14.3, 14.4, 14.5)
Unit V	Chapter 10 (10.1 to 10.8, 10.10, 10.12)
	Chapter 13 (13.1 to 13.4)

Reference Books
1. Roger S. Pressman, "Software Engineering: A Practitioner's Approach", McGraw-Hill, Seventh Edition, 2010.
2. Sommerville, "Software Engineering", Addison Wesley-Longman, Sixth Edition, 2004.

e – Resources
1. https://www.vssut.ac.in/lecture_notes/lecture1423904473.pdf
2. https://www.vssut.ac.in/lecture_notes/lecture1428551142.pdf
3. https://iare.ac.in/sites/default/files/lecture_notes/IARE_SE_Lecture%20Notes.pdf
4. https://www.slideshare.net/sivaayyakutti5/software-engineering-lecture-notes
5. https://www.youtube.com/watch?v=Ln_LP7c23WM&list=PLbRMhDVUMngf8oZR3Dp KMvYhZKga90JVt

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ELECTIVE - I

Title : Operating System	**Total Hours: 75 Hours**
Course Code : P22CAE11	**Total Credits: 5**

Course Outcomes

COs	CO Statement
CO1	Get an introduction about Operating System and Process Management concepts.
CO2	Learn about Asynchronous Concurrent Processes and Concurrent Programming.

CO3	Learn about Deadlock situations and precautions, Real Storage Management in System.
CO4	Learn Virtual Storage Organization and its Management Strategies.
CO5	Learn about Processor Scheduling algorithms and Disk Scheduling algorithms in detail.

Unit I   15 Hours
Operating Systems - Introduction; What is an Operating System – Different Views on an operating systems; Computer Organization – Computer System Operation, Storage Structure, I/O Structure;Evolution of Operating Systems – Serial Processing, Batch Processing, Multiprogramming; Types of Operating Systems – Batch Systems, Multiprogramming Systems, Real-time Systems, Distributed Systems; Operating System Services; Operating System Operations – Dual Mode, Timer; Concepts of Operating Systems – Process, Deadlock, Memory Management, Files, I/O Management; User Operating-System Interface – Command-line Interface, Graphical User Interface; System Calls – Types of System Calls; System Programs; System Structure – Simple Structure, Layered Approach, Microkernels, Modules; Virtual Machines.

Process Management - Introduction ; Basic Concepts – The Process, Process States, Process Control Block; Process Scheduling; Operations on Processes – Creation, Termination; Overview of Interprocess Communication – Shared Memory Systems, Message Passing Systems.

Unit II   15 Hours
Scheduling - Introduction; Scheduling Concepts; Scheduling Criteria; Scheduling Algorithms – FCFS Scheduling, SJF Scheduling, SRTN Scheduling, Priority Scheduling, HRN Scheduling, RR Scheduling, Multilevel Queue Scheduling, Multilevel Feedback Queue Scheduling; Multiple Processor Scheduling – Implementation of Ready Queue, Scheduling Approaches, Load Balancing, Process Affinity; Real-time Scheduling – Hard Systems, Soft Systems; Algorithm Evaluation.

Interprocess Communication - Introduction; Race Conditions; Critical Section; Hardware Solution; Semaphores; Classical IPC Problems – Producer Consumer Problem, Readers-Writers Problem, Dining-Philosophers Problem; Event Counters; Monitors; Message Passing.

Unit III   15 Hours
Deadlock - Introduction; Deadlock Problem; Deadlock Characterization – Deadlock Conditions, Resource Allocation Graph; Methods for Handling Deadlocks; Deadlock Prevention; Deadlock Avoidance – Banker's Algorithm for a Single Resource, Banker's Algorithm for Multiple Resource; Detection of Deadlock – Single Instance of Each Resource Type, Multiple Instances of a Resource Type; Deadlock Recovery – Terminating the Processes, Preempting the Resources.

Memory Management - Introduction; Background; Memory Management Strategies; Contiguous Memory Allocation – Single Partition, Multiple Partitions; Noncontiguous Memory Allocation – Paging, Segmentation; Swapping.

Unit IV   15 Hours
Virtual Memory - Introduction; Concept; Demand Paging – Performance of Demand Paging; Process Creation – Copy-on-Write; Page Replacement – (FIFO, Optimal, LRU, Second Chance, Counting-Based Algorithm; Allocation of Frames – Allocation Algorithms, Global versus Local Allocation; Thrashing – Working Set Model, Page Fault Frequency.

Input Output Management - Introduction; Principles of I/O Hardware – I/O Devices, Device Controllers, Direct Memory Access; Principles of I/O Software – Goals of I/O Software,

Programmed I/O, Interrupt-driven I/O; I/O Software Layers – Interrupt Handlers, Device Drivers, Device Independent I/O Software, User-level I/O Software.

Disks - Introduction; Magnetic Disk – Organization, Accessing Data; Disk Arm Scheduling Algorithms; Disk Formatting; Error Handling; Swap Space Management; RAID – Improving Performance and Reliability, RAID Levels.

Unit V   **15 Hours**

File Systems - Introduction; Files – File Naming, File Attributes, File Operations, File Types, File Structure, File Access, Memory-Mapped Files;Directories – Single-Level, Two-Level, Hierarchical, Directory Operations; File-System Mounting.

File System Implementation - Introduction; File System Structure – Layout; Implementing Files – Contiguous Allocation, Linked List Allocation, Linked List Allocation using Index, I-nodes; Implementing Directories – In MS-DOS. In UNIX, Efficiency and Performance; Shared Files; Disk Space Management – Managing the Free Space; File System Performance; File System Reliability – Backup and Restore, Consistency Checking; Log-Structured File System.

Case Study: Windows 2000 - Introduction; Structure of Windows 2000 – Hardware Allocation Layer, Kernel, Executive; Process and Thread Management in Windows – Interprocess Communication, Scheduling; Memory Management – Paging, Handling Page Faults; File System – NTFS Physical Structure, Metadata Files, Directory Implementation; I/O Management in Windows 2000.

Text Book

Rohit Khurana, "Operating System", Vikas Publishing House Pvt. Ltd, First Edition, 2013.

Unit I	Chapter 1 (1.1 – 1.13)
	Chapter 2 (2.1 – 2.5)
Unit II	Chapter 4 (4.1 – 4.7)
	Chapter 5 (5.1 - 5.9)
Unit III	Chapter 6 (6.1 – 6.8)
	Chapter 7 (7.1 – 7.6)
Unit IV	Chapter 8 (8.1 – 8.7)
	Chapter 9 (9.1 – 9.4)
	Chapter 10 (10.1 – 10.7)
Unit V	Chapter 11 (11.1 – 11.4)
	Chapter 12 (12.1 – 12.9)
	Chapter 16 (16.1 – 16.6)

Reference Books

1. Silberschatz, Galvin, Gagne, "Operating System Concepts", Wiley India Pvt Ltd., 2012.
2. William Stallings, "Operating Systems ", Pearson Education Inc., 2015.

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1. https://www.vssut.ac.in/lecture_notes/lecture1423726024.pdf
2. http://bcaraipur.blogspot.com/2014/05/operating-system-for-bca-full-refrence.html
3. http://www.svecw.edu.in/Docs%5CCSEOSLNotes2013.pdf
4. https://mrcet.com/downloads/digital_notes/CSE/II%20Year/OPERATING%20SYSTEMS%20%20NOTES%20R18.pdf
5. https://www.geeksforgeeks.org/last-minute-notes-operating-systems/

Course Title: Computer Graphics	Total Hours : 75 Hours
Course Code : **P22CAE12**/ P20CAE12	Total Credits : 5

Course Outcomes

COs	CO Statement
CO1	Understand the basic Graphics Applications and Graphic Devices.
CO2	Familiarize the algorithms for Graphical display.
CO3	Illustrate the 2D transformations.
CO4	Know the windowing and clipping algorithms.
CO5	Understand the techniques of 3D transformations and Animation.

Unit I 15 Hours
Introduction to Computer Graphics – Introduction; Non interactive/Interactive Graphics; Uses of Computer Graphics; Classification of Applications; Programming Language, Graphics and Operating Software; Graphic Systems Configuration.
GraphicsSystems – Introduction; Cathode Ray Tube (CRT) Basics; Refresh Display; Direct View Storage Tube(DVST); Raster Display; Input Devices; Output Devices; Computer Graphics Software; Integration of Graphics Standard; Interactive Graphics Techniques; Graphical User Interface(GUI).

Unit II 15 Hours
Output Primitives – Introduction; Representing Image; Straight Line; Line Drawing Algorithms; Differential Digital Analyser(DDA) Algorithm; Bresenham's Line Algorithm; Circle-Generating Algorithm; Bresenham's Circle Algorithm; Midpoint Circle Algorithm; Ellipse-Generating Algorithm; Midpoint Ellipse Algorithm; Polygon Filling Algorithm; Character or Text Generation; Aliasing and Antialising.

Unit III 15 Hours
Two-Dimensional Transformations – Introduction; Representation of Points; Matrix Algebra and Transformation; Transformation of Points; Transformation of Straight Line; Midpoint Transformation; Transformation of Parallel Lines; Transformation of Intersecting Lines; Rotation,Reflection and Scaling of Straight Line or Polygons; Combined Transformation; Translation and Homogeneous Coordinates; Rotation about an Arbitrary Point; Reflection about an Arbitrary Line.

Unit IV 15 Hours
Windowing and Clipping – Introduction; Viewing Transformation; Clipping; Point Clipping; Line Clipping; Cohen-Sutherland Line Clipping; Parametric Liang- Barsky 2D Line Clipping Algorithm; Polygon Clipping; Sutherland- Hodgman Algorithm; Curve Clipping; Text Clipping.

Unit V 15 Hours
3D Concepts and Techniques – Introduction; 3D Transformation-Projection; Orthographic Projection; Isometric Projection; Oblique Projection; Perspective Projection.
Animation – Introduction; Devices for Producing Animation; Computer-Assisted Animation; Video Formats; Frame-by-Frame Animation Techniques; Real-Time Animation Techniques; Animation Software.

Text Book

1. Amarendra N Sinha and Arun D Udai, "Computer Graphics", Tata McGraw Hill Education Private Linited, New Delhi, Fifth Reprint 2011.

Unit I	Chapter1,2
Unit II	Chapter3
Unit III	Chapter4
Unit IV	Chapter5
Unit V	Chapter7 (7.1 - 7.2,7.7 - 7.11) , 15

Reference Books

1. Donald Hearn, M. Pauline Baker, "Computer Graphics C Version", Pearson Education, 2nd Edition, Eighth Impression,2009.
2. V. K.Pachghare, "Computer Graphics", Laxmi Publications(P) LTD, Second Edition,New Delhi,2007.

e- Resources

1. https://www.javatpoint.com/computer-graphics-tutorial
2. https://www.geeksforgeeks.org/introduction-to-computer-graphics/
3. https://www.edx.org/course/computer-graphics-2
4. https://www.britannica.com/topic/computer-graphics
5. https://nptel.ac.in/courses/106/106/106106090/
6. https://nptel.ac.in/courses/106/103/106103224/
7. https://nptel.ac.in/courses/106/102/106102065/
8. https://onlinecourses.nptel.ac.in/noc21_cs97/preview

Course Title : Distributed Operating Systems	Total Hours : 75 Hours
Course Code : P22CAE13/ P20CAE13	Total Credits : 5

Course Outcomes

COs	CO Statement
CO1	Provide the fundamental concepts of distributed operating system.
CO2	Familiarize message passing and synchronization techniques.
CO3	Analyze RPC models working and distributed shared memory.
CO4	Know the synchronization and resource management approaches.
CO5	Understand the process management and distributed file processing models.

Unit I   **15 Hours**

Fundamentals - Distributed Computing System; Evolution of Distributed Computing Systems; Distributed Computing System Models; Distributed Computing Systems Gaining Popularity; Distributed Operating System; Issues in Designing a Distributed Operating System; Introduction to Distributed Computing Environment (DCE).

Unit II   **15 Hours**

MessagePassing – Introduction; Desirable Features of a Good Message–Passing System; Issues in IPC by Message Passing; Synchronization; Buffering; Multidatagram Messages; Encoding and Decoding of Message Data; Process Addressing; Failure Handling; Group Communication.

Unit III   **15 Hours**

Remote Procedure Calls – Introduction; The RPC Model; Transparency of RPC; Implementing RPC Mechanism; Stub Generation; RPC Messages; Marshalling Arguments and Results; Server Management.
Distributed Shared Memory – Introduction; General Architecture of DSM Systems; Design and Implementation Issues of DSM; Granularity; Structure of Shared Memory Space.

Unit IV   **15 Hours**

Synchronization - Mutual Exclusion; Deadlock; Election Algorithms.
Resource Management - Load-Balancing Approach; Load-Sharing Approach.

Unit V   **15 Hours**

Process Management – Introduction; Process Migration; Threads.
Distributed File Systems – Introduction; Desirable Features of a Good Distributed File System; File Models; File-Accessing Models; File-Sharing Semantics; File-Caching Schemes; File Replication; Fault Tolerance.

Text Book

1. Pradeep K.Sinha, "Distributed Operating Systems", Prentice-Hall of India PrivateLimited, 2008.

Unit I	Chapter1 (1.1 – 1.7)
Unit II	Chapter3(3.1 – 3.10)
Unit III	Chapter 4(4.1 – 4.8), Chapter 5(5.1 – 5.5)
Unit IV	Chapter6(6.4 – 6.6), Chapter7(7.4, 7.5)
Unit V	Chapter 8(8.1 – 8.3), Chapter 9(9.1 – 9.8)

Reference Book

1. Andrew S.Tannenbaum, "Distributed Operating Systems", Pearson Education, 2001.

e - Resources

1. https://www.javatpoint.com/distributed-operating-system
2. https://teachcomputerscience.com/distributed-operating-system/
3. https://ecomputernotes.com/fundamental/disk-operating-system/distributed-operating-system
4. https://www.cs.swarthmore.edu/~newhall/readings/p419-tanenbaum.pdf
5. https://www.youtube.com/watch?v=NYBKXzl5bWU
6. https://www.youtube.com/watch?v=Cz4k2aH5CLs

Course Title : LAB: Java Programming	Total Hours : 75 Hours
Course Code : **P22CAP11**/ P20CAP11	Total Credits : 3

Course Outcomes

COs	CO Statement
CO1	Implement Object Oriented programming concept using basic syntaxes of control Structures, strings and function for developing skills of logic building activity
CO2	Identify classes, objects, members of a class and the relationships among them needed for a finding the solution to specific problem
CO3	Demonstrate how to achieve reusability using inheritance, interfaces and packages and describes faster application development can be achieved.
CO4	Demonstrate understanding and use of different exception handling mechanisms and concept of multithreading for robust faster and efficient application development.

List of Programme:
1. Sorting n numbers using command-line arguments.
2. Implement programs using selection statements.
3. Implement program using Iteration statements.
4. To perform Matrix Operations.
5. Program to implement method overloading.
6. Program to implement method overriding
7. Program to use the Keyword 'Super'.
8. Program for pre-defined Exception.
9. Program for a User-Defined Exception.
10. Program to implement multilevel inheritance.
11. Program to use interface.
12. Program to implement user defined packages.
13. Program to implement the concept of Multithreading.
14. Program for String Manipulation
15. Program for Applet Animation

Course Title: LAB: Open Source Programming	Total Hours: 60 Hours
Course Code: **P22CAP12**	Total Credits: 2

Course Outcomes

COs	CO Statement
CO1	To implement simple PHP Scripts
CO2	Toimplement functions in PHP
CO3	To perform MySQL Queries through PHP
CO4	To perform advanced PHP techniques such as File upload, sessions, and authentications.

List of Programmes:

1. Write a PHP Program to Implement Operators and Decision Making Statements.
2. Write a PHP Program to Implement Iterations.
3. Write a PHP Program to Implement Arrays.
4. Write a PHP Program to Implement Functions.
5. Write a PHP Program to Perform String Operations.
6. Write a PHP Program to Implement 'include' and 'require' functions.
7. Write a PHP program to Copy from one file to another file
8. Perform the Following Operations in MySQL.

     (i) Create Database
     (ii) Drop Database
     (iii)Select Database

9. Perform the Following Operations in MySQL.

     (i) Create Tables
     (ii) Drop Tables
     (iii)Insert Query.

10. Perform the Following Operations in MySQL.

     (i) Select Query
     (ii) 'Where' Clause
     (iii)Update Query

11. Perform the Following Operations in MySQL.

     (i) Delete Query
     (ii) 'Like' Clause
     (iii)Sorting Results

12. Write a PHP Program to Connect MySQL Database to Display the Details of Particular Student.
13. Develop a Student Information System in PHP to allow View, Delete, Insert, Updatethe details of students.
14. Create a Login Module to Implement Sessions in PHP.
15. Create your own dynamic website using PHP and MySQL.
16. Write a PHP program to implement File operations
17. Write a PHP Program to Upload and Download Images from MySQL Database.
18. Create dynamic e-commerce website using AJAX
19. Create an Library management system using HTML,CSS,PHP,AJAX.

SEMESTER – II

Title : Python Programming	Total Hours: 60 Hours
Course Code: P22CAC21	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	Understand the basic concepts such as data types, Operators, Control Statements in Python
CO2	Understand Arrays, Strings, and Functions in Python
CO3	Understand Classes and Objects, Inheritance
CO4	Understand Exceptions, Date and Time functions in Python
CO5	Work on Database Connectivity in Python and Data Science using in Python

Unit I   **12 Hours**

Introduction to Python- Python; Features of Python; Execution of a Python Program; Viewing the Byte Code; Flavors of Python; Python Virtual Machine (PVM); Frozen Binaries; Memory Management in Python; Garbage Collection in Python

Datatypes in Python - How Python Sees Variables; Datatypes in Python; Built-in datatypes; bool datatype; Sequences in Python; Sets; Literals in Python; Determining the datatype of a variable; What about characters; User-defined Datatypes; Constants in Python; Identifiers and Reserved words; Naming Conventions in Pythons

Operators in Python - Operator; Arithmetic Operators; Using Python Interpreter as Calculator; Assignment Operators; Unary Minus Operator; Relational Operators; Logical Operators; Boolean Operators; Bitwise Operators; Membership Operators; Identity Operators; Operator Precedence and Associativity.

Unit II   **12 Hours**

Input and Output- Output statements; Input statements; Command Line Arguments

Control Statements - Control Statement;The if Statement;A word on Indentation;The if..else Statement;The if..elif..else Statement;The while Loop;The for Loop;Infinite Loops;Nested Loops;The else suite;The break statement; The Continue Statement

Arrays in Python- Array;Advantages of Arrays;Creating an array;Importing the Array Module;Indexing and Slicing on Arrays;Processing the Arrays;Types of Arrays;Working with Arrays using numpy;Creating Arrays using array();Creating Arrays using linspace;Creating Arrays using logspace;Creating Arrays using arange() function;Creating Arrays using zeros() and ones() Functions;Mathematical Operations on Arrays;Comparing Arrays;Aliasing the Arrays; Viewing and Copying Arrays.

Unit III   **12 Hours**

Strings and Characters- Creating Strings; Length of a String; Indexing in Strings; Slicing the Strings; Repeating the Strings; Concatenation of Strings; Checking Membership; Comparing Strings; Removing Spaces from a String; Finding Sub Strings; Counting Substrings in a String; Strings are Immutable

Functions - Difference between a Function and a Method;Defining a Function;Calling a Function;Returning Results from a Function;Returning Multiple Values from a Function;Functions are First Class Objects;Pass by Object Reference;Formal and Actual Arguments;Positional Arguments;Keyword Arguments;Default Arguments;Variable Length Arguments;Local and Global Variables;The Global Keyword;Passing a Group of Elements to a Function; Recursive Functions

Classes and Objects - Creating a Class;The Self Variable;Constructor;Types of Variables;Namespaces;Types of Methods.

Unit IV   **12 Hours**

Inheritance and Polymorphism- Constructors in Inheritance;Overriding Super Class Constructors and Methods;The Super() Method;Types of Inheritance; Method Resolution Order

Exceptions - Errors in a Python Program;Exceptions;Exception Handling;Types of Exceptions;The Except Block;The assert Statement;UserDefined Exceptions; Logging the Exceptions

Date and Time - The epoch;Date and Time Now;Combining Date and Time;Formatting Dates and Times;Finding Durations using 'timedelta';Comparing Two Dates;Sorting Dates;Stopping Execution Temporarily;Knowing the Time taken by a Program; Working with Calendar Module.

Unit V	12 Hours

Python's Database Connectivity - DBMS;Advantages of a DBMS over Files;Types of Databases used with Python;Installation of MySQL Database Software;Verifying the MySQL in the Windows Operating System;Installing MySQLdb Module;Verifying the MySQLdb Interface Installation;Working with MySQL Database; Using MySQL from Python;Retrieving All Rows from a Table;Inserting Rows into a Table;Deleting Rows from a Table;Updating Rows in a Table;Creating Database Tables through Python;Installation of Oracle 11g;Verifying Oracle Installation in Windows Operating System;Installing Oracle Database Driver;Verifying the Driver Installation;Working with Oracle Database;Using Oracle Database from Python;Stored Procedures.

Data Science Using Python - Data Frame;Data Visualization.

Text Book
1. Dr.R.Nageswara Rao, "Core Python Programming", Dreamtech Press, 2nd Edition, 2018.

Unit I	Chapter 1 Page No. 1 - 15 Chapter3 Page No. 49 - 69 Chapter4 Page No. 71 - 88
Unit II	Chapter5 Page No. 95 – 115 Chapter6 Page No.117 – 138 Chapter7 Page No. 151 – 182
Unit III	Chapter8 Page No. 207 – 221 Chapter9 Page No. 237 – 264 Chapter13 Page No. 351 - 367
Unit IV	Chapter14 Page No. 373 – 390 Chapter16 Page No. 421 – 439 Chapter20 Page No. 515 – 534
Unit V	Chapter 24 Page No.649 – 691 Chapter25 Page No. 693 - 712

Reference Books
1. Wesley J.Chun, "Core python programming", Pearson Education, 2001.
2. Allen B. Downey, "Think Python", O'Reilly Media, 2nd Edition, 2016

e -Resources
1. https://www.w3schools.com/python/
2. https://docs.python.org/3/tutorial/
3. https://en.wikipedia.org/wiki/Python_(programming_language)
4. https://www.guru99.com/python-tutorials.html

Course Title : Relational Database Management System	Total Hours :60 Hours
Course Code : P22CAC22	Total Credits : 4

Course Outcomes

COs	CO Statement
CO1	Draw the ER diagram for enterprise applications
CO2	Analyze the consequence of algebra in designing relational model and create database using query languages with constraints and security
CO3	Normalize databases to reduce cost due to redundancy constraints

CO4	Assess different types of scheduling and recovery techniques for concurrent transactions
CO5	Validate the query evaluation plan and optimize to reduce memory complexity

Unit I   **12 Hours**
Introduction - Purpose of Database Systems; View of Data; Database Languages;Relational Databases; Database Design; Data Storage Querying; Transaction Management; Database Architecture; Database Users and Administrators.
Database Design and the E-R Model–TheEntity Relationship Model;Constraints; Entity Relationship Diagrams; Extended E-R Features; Specialization; Generalization

Unit II   **12 Hours**
Introduction to the Relational Model - Structure of Relational Databases; Keys; Schema Diagrams; Relational Query Languages.
Formal Relational Query Languages - The Relational Algebra; The Tuple Relational Calculus; The Domain Relational Calculus.

Unit III   **12Hours**
Introduction to SQL – Overview of the SQL Query Language; SQL Data Definition; Basic Structure of SQL Queries; Additional Basic Operations; Set Operations; Null values; Aggregate Functions; Nested Subqueries.
Intermediate SQL -Join Expressions; Views; Transaction; Integrity Constraints; Authorization.
Advanced SQL - Functions and Procedures; Triggers.

Unit IV   **12 Hours**
Relational Database Design - Atomic domains and First Normal Form; Decomposition using Functional Dependencies; Keys and Functional Dependencies; Boyce Codd Normal Form; Third Normal Form, Functional Dependency Theory; Decomposition using Multivalued Dependencies; Multivalued Dependencies; Fourth Normal Form.

Unit V   **12 Hours**
Transactions - Transaction Concept; A Simple Transaction Model – Transaction Atomocity and Durability; Serializability.
Concurrency Control - Lock Based Protocols; Deadlock Handling, Time Stamp Based Protocols; Validation Based Protocols.
Recovery System– Failure Classification; Storage; Recovery and Atomicity;Recovery Algorithm.

Text Book
Abraham Silberschatz, Henry F Korth, S. Sudharshan, "Database System Concepts", McGraw Hill, 6th Edition – 2016

Unit I	Chapter 1 (1.2 – 1.9, 1.12)
	Chapter 7 (7.2, 7.3. 7.5, 7.8.1, 7.8.2)
Unit II	Chapter 2(2.1, 2.3 - 2.5),
	Chapter 6 (6.1 – 6.3)
Unit III	Chapter 3 (3.1 – 3.8), Chapter 4 (4.1 – 4.4,
	4.6), Chapter 5 (5.2, 5.3)
Unit IV	Chapter 8(8.2, 8.3.1, 8.3.2, 8.3.4, 8.4, 8.6.1,

	8.6.2)
Unit V	Chapter 14 (14.1, 14.2, 14.4, 14.6), Chapter 15 (15.1, 15.2, 15.4, 15.5), Chapter 16 (16.1 – 16.4)

Reference Books

1. R. Elmasri, S.B. Navathe, "Fundamentals of Database Systems", Pearson Education / Addison Wesley, Sixth Edition, 2014.
2. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", McGraw Hill, Third Edition, 2004.

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1. https://tamimdba.wordpress.com/relational-database-management-system-material/
2. https://www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
3. https://www.computersciencejunction.in/2019/11/24/relational-database-management-system/
4. https://www.vhnsnc.edu.in/e-content.php
5. https://www.jbiet.edu.in/coursefiles/cse/HO/cse2/DBMSI-III.pdf

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Course Title: Data Communications And Networks	Total Hours: 60 Hours
Course Code: P22CAC23/ P20CAC23	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	Identify the role of each layer in computer networks and its protocols.
CO2	Encode the data for transmission in wired and wireless medium.
CO3	Develop scheme for error detection and correction.
CO4	Select flow control algorithm at link to link level.
CO5	Evaluate the performance of various routing algorithms and Analyse the flow control and congestion control algorithms for QoS at end to end level.

Unit I   **12 Hours**
Introduction -Data Communications; Networks; Network Types; Internet History; Standards and Administration.
Network Models - TCP/IP Protocol Suite;The OSI Model.
Introduction to Physical Layer- Data and Signals; Digital Signals - Bit rate, Bit length; Transmission Impairment; Data rate limits - Noiseless Channel: Nyquist Bit rate, Noisy Channel: Shannon Capacity; Performance - Bandwidth, Throughput, Latency.

Unit II   **12 Hours**
Digital Transmission - Digital to Digital Conversion - Line Coding, Block Coding; Analogto Digital Conversion; Transmission Modes.
Analog Transmission - Digital to Analog Conversion - Amplitude Shift Keying, FrequencyShift Keying, Phase Shift Keying; Analog to Analog Conversion.
Bandwidth Utilization - Multiplexing.

Transmission Media - Guided Media - Unguided Media: Wireless.

Unit III	12 Hours

Switching – Introduction; Circuit switched Networks; Packet switching.
Introduction to Data Link Layer - Link Layer Addressing - Three types of Addresses; Address Resolution Protocol.
Error Detection and Correction – Introduction - Types of Errors; Block coding – ErrorDetection; Cyclic Codes - Cyclic Redundancy Check; Polynomials; Cyclic Code Encoderusing Polynomials; Checksum - Concept.
Data Link Control - DLC Services; Data Link Layer Protocols.

Unit IV	12 Hours

Media Access Control - Random Access; Controlled Access; Channelization.
Connecting Devices and Virtual LANs - Connecting Devices.
Introduction to Network Layer - Network Layer Services; Packet switching; IPV4addresses.
Unicast Routing - Routing algorithms.

Unit V	12 Hours

Introduction to Transport Layer – Introduction - Transport Layer Services; Transport LayerProtocols.
Standard Client Server Protocols - World Wide Web and HTTP; FTP; Electronic Mail;Telnet; Domain Name System - Namespace, DNS in Internet.

Text Book
Behrouz A. Foruzan, "Data communication and Networking", Tata McGraw-Hill,Fifth Edition, Ninth Reprint 2016.

Unit I	Chapter 1 (1.1 to 1.5) Chapter2 (2.2, 2.3) Chapter3 (3.1, 3.3.1, 3.3.2, 3.4, 3.5.1, 3.5.2, 3.6.1, 3.6.2, 3.6.3)
Unit II	Chapter4 (4.1.1, 4.1.3, 4.2, 4.3) Chapter5 (5.1.2 to 5.1.4, 5.2) Chapter 6 (6.1) Chapter7 (7.2, 7.3)
Unit III	Chapter8(8.1 to 8.3) Chapter9(9.2.1, 9.2.2) Chapter10 (10.1.1, 10.2.1, 10.3.1-10.3.3, 10.4.1) Chapter11(11.1, 11.2)
Unit IV	Chapter12(12.1, 12.2, 12.3) Chapter17 (17.1) Chapter 18(18.1, 18.2, 18.4) Chapter20(20.2)
Unit V	Chapter23(23.1.1, 23.2) Chapter 26(26.1 to 26.4, 26.6.1, 26.6.2)

Reference Books
1.William Stallings, "Data and Computer Communication", Pearson Education, Sixth Edition, 2000.
2. Andrew S. Tannenbaum, "Computer Networks", Pearson Education, Fourth Edition, 2003.

e - Resources
1. http://eti2506.elimu.net/Introduction/Books/Data%20Communications%20and%20Networking%20By%20Behrouz%20A.Forouzan.pdf
2. https://www.tutorialspoint.com/data_communication_computer_network/index.htm
3. https://www.javatpoint.com/computer-network-tutorial
4. https://www.guru99.com/data-communication-computer-network-tutorial.html
5. https://www.geeksforgeeks.org/computer-network-tutorials/

ELECTIVE - II

Course Title : Mobile Computing	Total Hours : 75 Hours
Course Code : P22CAE21/P20CAE21	Total Credits : 5

Course Outcomes

COs	CO Statement
CO1	Provide the basic concepts of mobile computing.
CO2	Understand the working principles of GSM and SMS.
CO3	Familiarize the techniques of GPRS and WAP.
CO4	Classify the techniques of Wireless LAN and designing applications for handheld devices.
CO5	Know the evolution of IMS and security issues of mobile computing.

Unit I   **15 Hours**
Introduction - Mobility of Bits and Bytes; Wireless-The Beginning; Mobile Computing; Networks; Middleware and Gateways; Applications and Services (Contents); Standard Bodies.
Mobile Computing Architecture - Architecture for Mobile Computing; Three-tier Architecture.
Emerging Technologies – Bluetooth; Radio Frequency Identification (RFID); Wireless Broadband (WIMAX); Mobile IP; Internet Protocol Version 6 (IPv6).

Unit II   **15 Hours**
Global System for Mobile Communications (GSM) - Global For Mobile Communications; GSM Architecture; GSM Entities; Call Routing in GSM.
Short message Service (SMS) - Mobile Computing Over SMS; Short Message Service (SMS); Value Added Service Through SMS.

Unit III   **15 Hours**
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 for GPRS.
Wireless Application Protocol (WAP) – Introduction; WAP; MMS; GPRS Application.
CDMA AND 3G - Third Generation Networks; Applications on 3G.

Unit IV   **15 Hours**
Wireless LAN - Wireless LAN Advantages; IEEE 802.11 Standards; Wireless LAN Architecture.
Client Programming – Introduction; Moving Beyond the Desktop; A Peek Under The Hood: Hardware Overview; Mobile Phones; Features of Mobile Phones; PDA; Design Constraints In Applications For Handle Held Devices.

Unit V	15 Hours

IP Multimedia Subsystem – Introduction; IMS and its Evolution; Benefits from IMS; Architecture of IMS Networks; Protocols used in IMS.

Security Issues in Mobile Computing – Introduction; Information Security; Security Techniques and Algorithms; Security Protocols; Public Key Infrastructure.

Text Book

1. Asoke.K.Talukder, Hasan Ahmed, Roopa.R.Yavagal, "Mobile Computing", McGraw Hill Education India Pvt Ltd, Second Edition, 2018.

Unit I	Chapter1 (1.1 - 1.3, 1.5 - 1.7, 1.11) Chapter2 (2.4, 2.5) Chapter4(4.2 - 4.6)
Unit II	Chapter5 (5.1 - 5.4) Chapter 6 (6.1 –6.3)
Unit III	Chapter 7 (7.1 – 7.7) Chapter 8 (8.1 - 8.4) Chapter 9 (9.6, 9.7)
Unit IV	Chapter10 (10.2 - 10.4) Chapter12 (12.1 - 12.7)
Unit V	Chapter19 (19.1 - 19.5) Chapter 20 (20.1 - 20.5)

Reference Books

1. Kumkum Garg, "Mobile Computing Theory and Practice", Pearson Education, 2010.
2. Sipra Dasbit, Biplab K. Sikdar, "Mobile computing", PHI Learning, 2009.

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1. https://www.tutorialspoint.com/mobile_computing/mobile_computing_overview.htm/
2. https://annamalaiuniversity.ac.in/studport/download/sci/cis/resources/MCA-Second%20Year-Mobile%20Computing-MCAC403.pdf
3. https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/mobile-computing
4. http://gecnilokheri.ac.in/GPContent/MOBILE%20COMPUTING%20UNIT-II%206th%20Sem%20CSE-converted.pdf
5. https://www.cet.edu.in/noticefiles/270_Lecture%20note%20@%20MC.pdf

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Course Title : Data Mining	Total Hours : 75 Hours
Course Code : P22CAE22/P20CAE22	Total Credits : 5

Course Outcomes

COs	CO Statement
CO1	Remember the concepts of the data mining techniques, algorithms, methods and tools.
CO2	Understand an application by using various data mining techniques to identify a pattern that evolves in various business domains.
CO3	Apply the patterns that can be extracted on application of data mining techniques in various domains.
CO4	Analyze the market needs by applying suitable OLAP operations.
CO5	Learn how data warehousing has become mainstream.

Unit I   **15 Hours**
Introduction - Basic Data Mining Tasks; Data Mining Versus Knowledge Discovery in Databases; Data Mining Issues; Data Mining Metrics; Social Implications of Data Mining; Data Mining from a Database Perspective.
Related Concepts - Database/OLTP systems; Fuzzy sets and Fuzzy Logic; Information Retrieval; Decision Support Systems; Dimensional Modeling; Data Warehousing; OLAP; Web Search Engines; Statistics; Machine Learning; Pattern Matching.
Data Mining Techniques – Introduction; A Statistical Perceptive on Data Mining; Similarity Measures; Decision Trees; Neural Networks; Genetic Algorithms.

Unit II   **15 Hours**
Classification – Introduction; Statistical-based Algorithms; Distance-based Algorithms; Decision Tree based Algorithms; Neural Network-based Algorithms; Rule-based Algorithms; Combining Techniques.
Clustering – Introduction; Similarity and Distance Measures; Outliers; Hierarchical Algorithms; Partitional Algorithms; Clustering Large Databases; Clustering with Categorical Attributes; Comparison.

Unit III   **15 Hours**
Association Rules – Introduction; Large Itemsets; Basic Algorithms; Parallel and Distributed Algorithms; Comparing Approaches; Incremental Rules; Advanced Association Rule Techniques; Measuring the Quality of Rules.
Web Mining - Introduction; Web Content Mining; Web Structure Mining; Web Usage Mining.

Unit IV   **15 Hours**
Spatial Mining – Introduction; Spatial Data Overview; Spatial Data Mining Primitives; Generalization and Specialization; Spatial Rules; Spatial Classification Algorithms; Spatial Clustering Algorithms.
Temporal Mining – Introduction; Modeling Temporal Events; Time Series; Pattern Detection; Sequences; Temporal Association Rules.

Unit V   **15 Hours**
Data Warehouse - The Building Blocks - Defining Features; Data Warehouse and Data Marts; Architectural Types; Overview of the Components; Metadata in the Data Warehouse.
Trends in Data Warehousing - Continued Growth in Data Warehousing; Significant Trends; Emergence of Standards; Web-enabled Data Warehouse.
Text Books
1. Margaret H. Dunham, "Data Mining Introductory and Advanced Topics", Pearson Education, 16th Impression, 2013.

Unit I	Chapter1(1.1 to 1.6)
	Chapter 2(2.1 to 2.11)
	Chapter 3(3.1 to 3.6)
Unit II	Chapter 4(4.1 to 4.7)
	Chapter 5(5.1 to 5.8)
Unit III	Chapter6(6.1 to 6.8)
	Chapter 7(7.1 to 7.4)
Unit IV	Chapter8(8.1 to 8.7)
	Chapter 9(9.1 to 9.6)

2. Paulraj Ponniah, "Data Warehousing Fundamentals for IT Professional", Wiley India Pvt. Ltd, 2nd Edition, 2015.

| Unit V | Chapter 2 (Page 24 to 42) |
| | Chapter 3 (Page 46 to 69) |

Reference Book

1. Jiawei Han, Micheline Kamber, "Data Mining Concepts and Techniques", 2nd Edition, Morgan Kaufmann Publisher, New Delhi, 2007.

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1. https://www.talend.com/resources/what-is-data-mining/
2. https://www.vssut.ac.in/lecture_notes/lecture1428550844.pdf
3. https://www.ibm.com/cloud/learn/data-mining
4. https://www.sas.com/en_us/insights/analytics/data-mining.html#:~:text=Data%20mining%20is%20the%20process,relationships%2C%20reduce%20risks%20and%20more.
5. https://nptel.ac.in/courses/106/105/106105174/
6. https://onlinecourses.nptel.ac.in/noc20_cs12/preview

| Title : Cloud Computing | Total Hours: 75 Hours |
| Course Code : P22CAE23 | Total Credits: 5 |

Course Outcomes

COs	CO Statement
CO1	Understand cloud computing architecture, Advantages and Disadvantages.
CO2	Understand deployment models and Services Models.
CO3	Implement virtualization in cloud.
CO4	Illustrate networking and open source for cloud.
CO5	Know security and future of cloud computing.

Unit I   **15 Hours**
Cloud Computing Fundamentals- Motivation for Cloud Computing; Defining CloudComputing; 5-4-3 Principles of Cloud computing; Cloud Ecosystem; Requirements forCloud Services; Cloud Application; Benefits and Drawbacks.
Cloud Computing Architecture and Management- Cloud Architecture; Anatomy of theCloud; Network Connectivity in Cloud Computing; Applications on the Cloud;Managing the Cloud; Migrating Application to Cloud.

Unit II   **15 Hours**
Cloud Deployment Models- Introduction; Private Cloud; Public Cloud; CommunityCloud; Hybrid Cloud.
Cloud Service Models- Introduction; Infrastructure as a Service; Platform as a Service; Software as a Service; Other Cloud Service Models.

Unit III   **15 Hours**
Technological Drivers for Cloud Computing- SOA and Cloud; Virtualization; MulticoreTechnology; Memory and Storage Technologies; Networking Technologies; Web 3.0.
Virtualization- Introduction; Virtualization Opportunities; Approaches to Virtualization; Hypervisors; From Virtualization to Cloud Computing.

Unit IV   **15 Hours**

Software Development in Cloud- Introduction; Different Perspectives on SaaSDevelopment; New Challenges; Cloud-Aware Software Development Using PaaSTechnology.

Networking for Cloud Computing- Introduction; Overview of Data Center Environment; Networking Issues in Data Centers.

Cloud Service Providers – EMC; Google; Amazon Web Services; Microsoft.

Unit V   **15 Hours**

Security in Cloud Computing- Introduction; Security Aspects; Platform-Related Security; Audit and Compliance.

Advanced Concepts in Cloud Computing- Intercloud; Cloud Management; MobileCloud; Media Cloud; Interoperability and Standards; Cloud Governance; ComputationalIntelligence in Cloud; Green Cloud; Cloud Analytics.

Text Book

1. K. Chandrasekaran, "Essentials of Cloud Computing"*,* CRC Press, 2015.

Unit I	Chapter 2(2.1 to 2.7)
	Chapter 3(3.2 to 3.7)
Unit II	Chapter 4 (4.1 to 4.5)
	Chapter 5(5.1 to 5.5)
Unit III	Chapter 6 (6.2 to 6.6, 6.8)
	Chapter7 (7.1 to 7.5)
Unit IV	Chapter 9 (9.1 to 9.4)
	Chapter10 (10.1 to 10.3)
	Chapter 11(11.2 to 11.5)
Unit V	Chapter 13 (13.1 to 13.4)
	Chapter 14 (14.1 to 14.9)

Reference Books

1. V.K.Pachghare, "Cloud Computing", PHI Learning Private Limited, 2016.
2. Anthony T.Velte, Toby J.Velte, Robert Elsenpeter, "Cloud Computing by A PracticalApproach"*,* Tata McGraw-Hill Education Private Limited, New Delhi, 2010 Edition, FifthReprint 2011.

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1. https://www.iare.ac.in/sites/default/files/lecture_notes/CC%20LECTURE%20NOTES.pdf
2. https://mrcet.com/downloads/digital_notes/CSE/IV%20Year/(R17A0527)%20Cloud%20 Computing%20Digital%20Notes.pdf
3. https://web2.qatar.cmu.edu/~msakr/15319-s10/lectures/lecture02.pdf
4. https://krishnamoorthymca99.wordpress.com/cloud-computing/ https://annamalaiuniversity.ac.in/studport/download/engg/CSE_Engg/resources/B.E._CS E_4Y_8SEM_CLOUD%20COMPUTING%2006oE8021.pdf

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Title : Internet and Web Designing	Total Hours: 60 Hours
Course Code : P22CAN21	Total Credits: 4

Course Outcomes

COs	CO Statement
CO1	Understand the basic concepts of Internet and WWW.
CO2	Design web pages using HTML Basic Tags and understand the various sections.
CO3	Understand how to insert ordered and unordered lists within a web page.
CO4	Understand how to insert link and table within a web page.
CO5	Understand how to insert frames and forms within a web page.

Unit I   **12 Hours**
Introduction to the Internet -Networking; Internet; Electronic Mai, Resource Sharing; Gopher; World WideWeb; Usenet; Telnet.
Introduction to HTML -Designing a Home Page; History of HTML; HTMLGenerations; HTML Documents; AnchorTag; Hyper Links.

Unit II   **12 Hours**
Head and Body Sections - Header section; Title; Prologue; Links; Colorful web page; Comment lines.
Designing the body section - Heading printing; Aligning the Headings; Horizontal Rule; Paragraph; Tab settings; Images and Pictures; Embedding PNG Format Images.

Unit III   **12 Hours**
Ordered and Unordered lists - Lists; Unordered list; Headings in a list; Ordered list; Nested lists.
Table handling -Tables; Table creation in HTML; Width of the table and cells; Cells spanning multiple rows/columns; Coloring cells; Column specification.

Unit IV   **12 Hours**
Frames -Frameset definition; Frame Definition; Nested framesets.

Unit V   **12 Hours**
Forms -Action attribute; Methodattribute; Enctype attribute; Drop Down List; Sample Forms.

Text Book
1. C.Xavier,"World Wide Web Design with HTML", Tata McGraw Hill Education Private Limited,First Edition, 2014.

Unit I	Chapter 1 (1.2 – 1.9)
	Chapter 4 (4.1 – 4.6)
Unit II	Chapter 5 (5.1 – 5.6)
	Chapter 6 (6.1 - 6.7)
Unit III	Chapter 7 (7.1 – 7.5)
	Chapter 8 (8.1 – 8.6)
Unit IV	Chapter 10 (10.1 – 10.3)
Unit V	Chapter 12 (12.1 – 12.5)

Reference Book

1. Ivan Bayross,"Web enabled commercial Application Development using HTML,JavaScript, DHTML and PHP", BPB Publications, Fourth Revised Edition, 2013.

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1. https://www.tutorialspoint.com/html/html_tutorial.pdf
2. https://www.w3schools.com/html/
3. https://www.tutorialspoint.com/html/index.htm
4. https://html.com/
5. https://www.geeksforgeeks.org/html-tutorials/

Course Title : LAB: Python Programming	Total Hours :60 Hours
Course Code : P22CAP21	Total Credits : 2

Course Outcomes

COs	CO Statement
CO1	Create programs using the basic concepts such as data types, Control Statements in Python.
CO2	Create programs using the concepts such as Arrays, Strings, and Functions in Python.
CO3	Create programs using the concepts such as Classes and Objects, Inheritance
CO4	Create programs using Exceptions, Database Connectivity in Python.

1. A Python Program to Implement 'Basic Data types'.
2. A Python Program to Implement 'List'.
3. A Python Program to Implement 'Tuples'.
4. A Python Program to Implement 'Range'.
5. A Python Program to Implement 'Control Statements'.
6. A Python Program to Implement 'if..else Statement'.
7. A Python Program to Implement 'Arrays'.
8. A Python Program to Implement 'Strings and Characters'.
9. A Python Program to Implement 'Functions'.
10. A Python Program to Implement 'Classes and Objects'.
11. A Python Program to Implement 'Inheritance and Polymorphism'.
12. A Python Program to Implement 'Exceptions'.
13. A Python Program to Implement 'Date and Time'.
14. A Python Program to Implement 'Python's Database Connectivity' using Oracle.
15. A Python Program to Implement 'Python's Database Connectivity' using MySQL.

Course Title : LAB: Relational Database Management System	Total Hours : 75 Hours
Course Code : P22CAP22	Total Credits : 3

Course Outcomes

COs	CO Statement
CO1	Populate and query a database using SQL DML/DDL commands
CO2	Declare and enforce integrity constraints on a database using a state-of-the-art RDBMS
CO3	Do Programmes on PL/SQL including stored procedures, stored functions, cursors and packages
CO4	Design and build a GUI application using any programming language as front end

1. Data Definition Language
2. Data Manipulation Language
3. Data Control Language
4. Transaction Control Language
5. Set Operators
6. Join Operations
7. Views and Indexes
8. Nested Queries
9. SQL Built-in Functions
10. PL/SQL Simple Programs
11. PL/SQL – Cursors
12. PL/SQL - Triggers