Annexure 15.2

Avinashilingam Institute for Home Science and Higher Education for Women
(Deemed to be University Estd. u/s 3 of UGC Act 1956, Category A by MHRD)
Re-accredited with A++ Grade by NAAC. CGPA 3.65/4, Category I by UGC
Coimbatore - 641 043, Tamil Nadu, India

Department of Computer Science
Master of Computer Applications

Two Year Programme

Programme Outcomes

PO1: Apply knowledge of Computer Science to applications involving interrelated disciplines.

PO2: Design solutions for various domains to meet the specific needs of society and industry.

PO3: Use appropriate technology to design, experiment, develop and interpret data and prove valid conclusions.

PO4: Create, select, and apply appropriate techniques, resources, and modern IT tools and techniques to offer solutions.

PO5: Apply the contextual knowledge and the consequent responsibilities to computing practices

PO6: Understand the impact of the computing solutions in societal and environmental contexts.

PO7: Apply ethical principles and responsibilities to IT practices.

PO8: Function effectively as an individual, and as a member or leader in diverse teams, and in multi-disciplinary settings.

PO9: Communicate effectively at a team level in activities related to software development.

PO10: Demonstrate knowledge and understanding of the software management principles and apply these in various roles.

PO11: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes

PSO1: Analyze, formulate, design and develop software solutions for realworld problems.

PSO2: Prepare students to apply cutting edge technologies in the field of computer applications.

PSO3: Create skills relevant to team building and management in the context of software development.

Scheme of Instruction and Examination
(For students admitted from 2023 - 2024 & onwards)

Part	Subject Code	Name of paper/component	Hours of Instructions/week		Scheme of Examination				
			Theory	Practical	Duration of exam	CIA	CE	Total	Credit
First Semester									
I	23MCAC01	Mathematical Foundations of Computer Applications	4	-	3	40	60	100	4
	23MCAC02	Computer Systems and Architecture	4	-	3	40	60	100	4
	23MCAC03	Data Structures and Algorithms	4	-	3	40	60	100	4
	23MCAC04	Relational Database Management System	4	-	3	40	60	100	4
	23MCAC05	Programming in C++	4	-	3	40	60	100	4
	23MCAC06	Computing Lab I – C++	-	4	3	40	60	100	3
	23MCAC07	Computing Lab II - Relational Database Management System	-	4	3	40	60	100	3
II		CSS/Adult Education/ Community Engagement and Social Responsibility	2	-	-	-	-	-	-
Second Semester									
I	23MCAC08	Optimization Techniques	4	-	3	40	60	100	4
	23MCAC09	Software Engineering	4	-	3	40	60	100	4
	23MCAC10	Operating Systems	4	-	3	40	60	100	4
	23MCAC11	Data Communication and Networks	4	-	3	40	60	100	4
	23MCAC12	Data Mining and Warehousing	4	-	3	40	60	100	4
	23MCAC13	Computing Lab III - Python Programming	-	3	3	40	60	100	2
	23MCAC14	Mini Project	1	-	-	100	-	100	2
		Interdisciplinary Course	4	-	3	40	60	100	4
II	23MXCSS1/ 23MXAED1/ 23MXCSR1	CSS/Adult Education/ Community Engagement and Social Responsibility	2	-	-	-	-	100	2
		Professional Certification	-	-	-	-	-	-	2
Internship during Summer Vacation for one month									

Third Semester									
I	23MCAC15	Accounting and Managerial Decision	4	-	3	40	60	100	4
	23MCAC16	Software Project Management	4	-	3	40	60	100	4
	23MCAC17	Data Science (Open Book)	3	-	3	100	-	100	3
	23MCAC18	Artificial Intelligence	4	-	3	40	60	100	4
	23MCAC19	Cyber Security	4	-	3	40	60	100	3
	23MCAC20	Computing Lab IV – PHP and MYSQL	-	4	3	40	60	100	3
	23MCAC21	Computing Lab V- R Programming	-	4	3	40	60	100	3
	23MCAC22	Technical Communication **(Self- Study Course)**	1	-	3	100	-	100	4
		Multi-Disciplinary Course	2	-	-	100	-	100	2
.II	23MCAC23	Internship	-	-	-	100	-	100	2
Fourth Semester									
I	23MCAC24	Project	-	30	-	100	100	200	8
Part I Components									**92**
Part II Components									**6**
Total credits									**98**

Part –II Components

Part	*Subject Code*	*Name of paper/component*	*Hours of Instructions/week*		*Scheme of Examination*				
			Theory	*Practical*	*Duration of exam*	*CIA*	*CE*	*Total*	*Credit*
		Professional Certification Courses							2
	23MCAC23	Internship	-	-	-	100	-	100	2
	23MXCSS1/ 23MXAED1/ 23MXCSR1	CSS/Adult Education/ Community Engagement and Social Responsibility	2	-	-	-	-	-	2

- **MOOC Course 2 to 4 credits**

Minimum 98+ 2 credits to earn the degree.

- **Courses offered by the Department to other PG Programmes:**

1. **Interdisciplinary Course – 23MCSI01 - Social Computing**
   23MCSI02 - Machine Learning using Excel
2. **Multidisciplinary Course –**
   23MCSM01 - Cyber Security and Cyber Law
   23MCSM02 - Machine Learning for Biochemistry, Biotechnology
   23MCSM03 - Machine Learning for Chemistry
   23MCSM04 - Mobile Application Development
   23MCSM05 - G-Suite for Front Office

- **Part II – Professional Certification courses**

23MCSPC1 VM Ware/Network security
23MCSPC2 Internet of Things
23MCSPC3 Robotic Process Automation
23MCSPC4 Design Visualization Program using 3D Studio Max
23MCSPC5 Power BI
23MCSPC6 Cloud Computing
23MCSPC7 Industrial IoT on Google Cloud
23MCSPC8 IoT with Machine Learning

Mathematical Foundations of Computer Applications

Semester I **Hours of Instructions / Week: 4**

23MCAC01 **No. of Credits: 4**

Objectives:

1. Enable the students to gain knowledge about basic concepts of Set Theory, Probability.
2. Introduce Students to Regression and Correlation.
3. Introduce Automata Theory and Numerical Methods.

Unit I: Matrices and Set Theory **-12Hrs**

Types of Matrices - Matrix Operations – Inverse of Matrix – (Properties of Determinants)* – Eigen Values - Cayley–Hamilton Theorem. Basic Set Operations – Relations and Functions – Relation Matrices – Principles of Mathematical Induction

Unit II: Introduction to Probability **-12Hrs**

Sample space and Events – (Axioms of Probability)*– Conditional Probability – Independence of Events – Baye"s Theorem.

Unit III: Regression and Correlation **-12Hrs**

(Linear Regression)* – Method of Least Squares – Correlation Coefficient – Rank Correlation Coefficient.

Unit IV: Introduction to Formal Languages, Grammars and Automata **-12Hrs**

Introduction - Types of Grammars and languages – (Derivation Trees)*- Automata - Finite State Automata – Non Deterministic finite Automata. Conversion of NDFSA to DFSA.

Unit V: Numerical Methods **-12Hrs**

Finding Roots: (Bisection Method)* - Regula-Falsi Method Newton Raphson Method. Solution of Simultaneous Linear Equations - Gauss-Elimination Method – Gauss–Seidal Method. Numerical Integration: Trapezoidal Rule – Simpson"s $1/3^{rd}$ and $3/8^{th}$ Rules.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. M.K. Venkatraman, (2015) ***"Engineering Mathematics"***, Vol II, National Pub Company.
2. RadhaMuthu, T. Santha, (2016), ***"Discrete Mathematics for Computer Science and Applications"***, Kalaikathir Achchagam, Coimbatore.
3. Goel and Mittal, (2018), ***"Numerical Analysis in Engineering"***, Pragati Prakashan, Merut.
4. S.P. Gupta, (2019), ***"Statistical Method"***, Forty Sixth Edition, Sultan Chand & Sons, New Delhi.

E-learning Resources:

1. http://cec.nic.in/E- Content / Pages/ Result.aspx ? p=Paper16&s=MATH&Name =Mathematics &Paper Name =Numerical% 20Analysis.
2. http://nptel.ac.in/downloads/108108079/

Course Outcomes:

CO1: Recall the concepts of matrices, set theories, relations, functions

CO2: Apply proving techniques of induction for statements.

CO3: Be familiar with fundamental notions of probability, regression and analyze real world problems.

CO4: Model grammars and languages and able to devise languages accepted by finite state automata.

CO5: Derive numerical methods for finding roots, integration, solution of linear and Non-linear equations

CO/ PO	PO1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	H	-	-	-	-	M	-	M	-	-	L	M	M	H
CO2	H	-	-	-	-	M	-	M	-	-	L	M	M	H
CO3	H	-	-	-	-	M	-	M	-	-	L	M	M	H
CO4	H	-	-	-	-	M	-	M	-	-	L	M	M	H
CO5	H	-	-	-	-	M	-	M	-	-	L	M	M	H

Computer Systems and Architecture

Semester I **Hours of Instructions / Week: 4**

23MCAC02 **No. of Credits: 4**

Objectives:

1. Introduce number systems, and basic postulates of Boolean algebra.
2. Outline the formal procedures for the analysis and design of combinational and sequential circuits.
3. Understand in detail the operation of the arithmetic logic and Control Unit.
4. Study the types of memory and different ways of communicating with I/O devices.

Unit I: Number Systems and Boolean Algebra **-12Hrs**

Decimal, Binary, Octal and Hexadecimal number Systems –(Weighted and non-weighted codes)* - Logic gates-NAND/NOR implementation - Truth Tables - Basic laws of Boolean Algebra - De-Morgan"s Theorems – SOP-POS - Karnaugh map.

Unit II: Combinational and Sequential Logic Circuits **-12Hrs**

Adder – Subtractor circuits – Code converters – Flip-flops: S-R, D, J-K, T – (Master-slave – Shift register)*- Ripples and Synchronous Counters.

Unit III: Computer Arithmetic and control **-12Hrs**

Introduction – Addition and Subtraction Algorithms - Multiplication Algorithm – Booth Multiplication – Division Algorithm= (Hardwired and Micro programmed control)*= Control Memory - Address Sequencing.

Unit IV: Memory Organization **-12Hrs**

(Memory Hierarchy - Primary and Secondary Memories)* - Associative Memory - Cache Memory - Virtual Memory.

Unit V: Input-Output Organization **-12Hrs**

(Peripheral Devices)* - Input-Output Interface - Asynchronous Data Transfer – Modes of Transfer - Direct Memory Access (DMA).

*** Indicates Self- Study Component**

Total Hours: 60

Reference Books:

1. Thomas C. Bartee, (2011), ***"Digital Computer Fundamentals"***, 30th Reprint, Tata McGraw Hill.
2. M. Morris Mano, Charles Kime, (2013),***"Logic and Computer Design Fundamentals"***, Pearson Education Limited.
3. M. Morris Mano, (2008), ***"Computer System Architecture"***, Third Edition, Prentice Hall of India.
4. Aharon Yadin, (2016), ***"Computer Systems Architecture"***, Third Edition, CRC Press,International Student Edition, Morgan Kaufmann Publishers.

E-learning Resources:

1. https://tutorialspoint.dev/computer-science/digital-electronics-and- logic-design
2. https://www.studytonight.com/computer-architecture/

Course Outcomes:

CO1: Plan and apply Boolean Logic in circuit design.

CO2: Distinguish the design of combinational and sequential circuits.

CO3: Relate the approaches used in computer arithmetic and control implementation.

CO4: Appraise the various information storage and retrieval concepts.

CO5: Interpret the recent updations in Input-Output transfer schemes.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	M	M	L	L	-	M	L	M	L	H	H	M
CO2	H	L	L	L	L	L	-	M	L	L	L	H	M	M
CO3	M	-	L	L	L	-	-	-	-	L	L	M	L	M
CO4	L	L	-	L	-	-	-	-	L	L	-	L	-	L
CO5	L	L	-	-	-	-	-	-	-	L	-	-	-	L

Data Structures and Algorithms

Semester I **Hours of Instructions / Week: 4**

23MCAC03 **No. of Credits: 4**

Objectives:

1. Understand the different methods of organizing linear and non- linear data.
2. To study the various file organizations and storage management.
3. Enable understanding of various searching and sorting techniques.

Unit I: Primitive data types and Analysis of algorithms **-12 Hrs**

Introduction: Overview of Data Structures – A Philosophy of Data Structures – The Need for Data Structures – Cost and Benefits – Abstract Data Types and Data Structures - Basic complexity analysis – Best, Worst, and Average Cases – Asymptotic Analysis -Analyzing Programs - (Analysis of algorithms – time and space analysis – notations)*, Arrays, Stacks and Queues: Stack ADT – Array based Stacks, Linked Stacks – Implementing Recursion using Stacks, Queues – ADT, Array based Queue, Linked Queue, Double ended queue, Circular queue- Priority queues

Unit II: **Linked Data Structure and applications of Linked List** **-8 Hrs**

Linked Lists and Recursion: Using Arrays – Lists – Array based List Implementation – Linked Lists – LL ADT – Singly Linked List – Doubly Linked List – Circular Linked List – recursion- linear, binary, and multiple recursions- Applications of linked Linear lists - Polynomial manipulation – (Linked dictionary)*

Unit III: Nonlinear data structures and their representation **-14 Hrs**

Search trees – Binary search tree, AVL tree, Trees – K-D Trees – B-Trees. Sorting and Selection – Linear Sorting – Heap Sort – Divide and Conquer Strategy – Merge Sort – Quick Sort — External Memory Sorting and Searching. Graphs: ADT- Data structure for graphs – Graph traversal- Transitive Closure- Directed Acyclic graphs – Weighted graphs – Shortest Paths – Minimum Spanning Tree – (Greedy Methods for MST)*.

Unit IV: File Structures **-13 Hrs**

External storage devices - Record organization – (Sequential files)* - Structure and processing sequential files - Indexed sequential files - Direct files -Hashing function - Dynamic hashing techniques - Organizing direct access files with hashing - Virtual hashing

Unit V: Advanced Data Structure: **-13 Hrs**

Backtracking – N-Queen's Problem - Branch and Bound – Assignment Problem - P & NP problems – NP-complete problems – Approximation algorithms for NP-hard problems – Traveling salesman problem-(Amortized Analysis.)*

***Indicates Self - Study Component**

Total Hours: 60

***Reference Books*:**

1. Sahni Horowittz, (2013), ***"Fundamentals of Data Structure in C"***, Second Edition, Universities Press.
2. Jean - Paul Tremblay & Sorenson, (2017), ***"An Introduction to Data Structures with Applications"***, International Student Edition, McGraw Hill.
3. Rohit Khurana, (2016),***"Data & FileStructures"***, Second Edition, Vikas Publication.

E-learning Resources:

1. https://www.w3schools.in/data-structures-tutorial/intro/
2. https://www.programiz.com/dsa
3. https://nptel.ac.in/courses/106102064/1

Course Outcomes:

CO1: Analyze the behavior of basic data structures and algorithms and Construct stack and queue data structures and evaluate its operations

CO2: Apply linear and nonlinear data structures to programming solutions

CO3: Create tree and evaluate its types and operations, create graph datastructures, implement algorithms to identify shortest path

CO4: Propose and File storage and indexing techniques

CO5: Gain knowledge on data organization using advanced data structures.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	M	H	L	H	-	L	H	-	-	H	M	L	L
CO2	H	M	M	L	H	-	M	H	L	-	H	M	M	-
CO3	H	H	M	L	H	-	M	H	M	-	L	M	M	L
CO4	H	H	M	L	H	-	M	H	M	-	H	M	M	L
CO5	H	L	L	L	M	-	L	L	-	-	L	-	-	-

Relational Database Management System

Semester I **Hours of Instructions / Week: 4**

23MCAC04 **No. of Credits: 4**

***Objectives*:**

1. Learn the fundamentals of Relational Database and Relational Database Management System
2. Acquire knowledge on Relational database design and SQL.
3. To gain knowledge on Transaction Management, Recovery and Storage Structures.

Unit I: Introduction to Relational Databases **-12Hrs**

Purpose of Database System -– Views of data – Data Models – Database System Concepts and Architecture –Data Modelling using Entity–Relationship model – ER Diagrams -- Introduction to relational databases -The relational Model –Keys– SQL fundamentals - Advanced SQL features – Embedded SQL–(Dynamic SQL)*.

Unit II: The relational Data Model And SQL **-12Hrs**

The Relational Data Model and Relational Database Constraints-Basic SQL- Complex Queries, Triggers, Views, and Schema Modification-The Relational Algebra and Relational Calculus-(PL/SQL Concepts)*, NO – SQL, Postgre SQL, SQLite, MongoDB

Unit III: Normalization **-12Hrs**

Functional Dependencies – Functional Dependencies based on primary keys– Second, Third Normal Forms, Dependency Preservation – Boyce-Codd Normal Form-(Comparison of Boyce-Codd and Third Normal Form)*- Multi-valued Dependency and Fourth Normal Form – Join Dependencies and Fifth Normal Form

Unit IV: Transaction Management **-12Hrs**

Transaction Concepts - Properties of Transactions– serializability of transactions - System recovery, Two- Phase Commit protocol-Recovery and Atomicity-Log-based recovery-(concurrent executions of transactions and related problems)*-Locking mechanism-solution to concurrency related problems-deadlock- two-phase locking protocol

Unit V: Storage and Query Processing **-12Hrs**

(Storage and File structure)*– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing

*** Indicates Self - Study Component**

Total Hours: 60

***Reference Books*:**

1. Ramez Elmasri and Shamkant B. Navathe (2017),*"Fundamentals of Database Systems"*, Seventh Edition, Pearson Publication
2. Abraham Silbers chatz, Henry F.Korth and S.Sudarshan *(2013). "Database System Concepts"*, Sixth Edition, MCGrawHill Publication.

***E-learning Resources*:**

1. https://www.pearson.com
2. www.tutorialspoint.com/sql/sql-rdbms-concepts.htm
3. beginnersbook.com/2015/04/rdbms-concepts
4. beginnersbook.com/2015/04/dbms-tutorial
5. www.tutorialspoint.com/dbms/index.html

Course Outcomes:

CO1: Understand data base concepts and RDBMS.

CO2: Evaluate relational data bases using SQL Queries.

CO3: Apply normalization on tables.

CO4: Appraise on properties of Transactions, Concurrency Control and Recovery techniques.

CO5: Assess the storage structures suitable for the data base.

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H			H	H						L	L	
CO2			H	H	H				M			M	M	
CO3		H	H		H				M			M	M	
CO4						L		M		M		L	L	
CO5					L	L				M	L	M	L	L

Programming in C++

Semester I **Hours of Instructions / Week: 4**

23MCAC05 **No. of Credits: 4**

Objectives

1. To understand the difference between object-oriented programming and procedural programming
2. To understand the concept of deriving instances of classes
3. To build C++ classes using appropriate encapsulation and design principles

Unit I: Introduction to Object Oriented Programming **-12Hrs**

Comparison with procedural and structured programming – Classes and objects – (Data Abstraction – Encapsulation – Inheritance – Polymorphism) * - Dynamic binding - Message passing. Advantagesof object orientation – Reusability – Maintenance – Security - Comfort in Programming - Input and output streams in C++ - Basic data types and declarations – Functions in C++

Unit II: Classes and Objects **-12Hrs**

Introduction, Classes in C++, Declaring Objects, Access Specifiers and their Scope - Static member Functions - Static Object - Array of Objects - Objects as Function Arguments - Friend functions - Constructors and Destructors – (Polymorphism - Operator Overloading and Type conversion)*.

Unit III: Inheritance **-12Hrs**

Introduction – Reusability - Access Specifiers - Parent and child classes - Private, public and Protected inheritance - Types of Inheritances - (Single Inheritance - Multilevel Inheritance - Multiple Inheritance - Hierarchical Inheritance - Hybrid Inheritance)* - Virtual Base Classes – Abstract classes

Unit IV: Binding & Polymorphism **-12Hrs**

Early Binding - Late Binding - Pointers to derived class objects - Virtual Functions - Rules for Virtual Functions - Pure Virtual Functions - Working of Virtual Functions - Virtual Functions in Derived Classes - Object Slicing – (Constructors and Virtual Functions)*

Unit V: Application with Files **-12Hrs**

Introduction - File Stream Classes - File Opening Modes - File Pointers and Manipulators - Manipulators with Arguments - Sequential Access Files - Binary and ASCII Files Random Access Operation – (Class Template - Functions Templates - Exception Handling Mechanism)*.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Ashok N. Kamthane, (2013), ***"Programming in C++"***, Second Edition, Pearson Education.
2. E. Balagurusamy, (2013), ***"Object Oriented Programming with C++"***, Sixth Edition, McGraw Hill.
3. Venugopal, RajKumar Buyya, (2013), "***Mastering C++"***, McGraw Hill

E-learning Resources:

1. http://cec.nic.in/e-content/Pages/default.aspx
2. http://spoken-tutorial.org/tutorial-search/?search_foss=C+and+Cpp&search_language=English
3. http://nptel.ac.in/courses/106102066/

Course Outcomes:

CO1: Describe the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects.

CO2:Understand dynamic memory management techniques using pointers, constructors, destructors, etc

CO3: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.

CO4: Classify inheritance with the understanding of early and late binding.

CO5: Recall generic programming, templates, file handling

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO2	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO3	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO4	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO5	H	H	H	H	M	M	H	M	M	L	L	H	M	M

Computing Lab I – C++

Semester I **Hours of Instructions / Week: 4**

23MCAC06 **No. of Credits: 3**

Objectives:

1. Understand the fundamental principles of Object-Oriented Programming concepts
2. Acquire programming skills in C++ by applying object-oriented paradigms
3. Build up the capacity to write programs for developing simple applications

List of Programs

1. Program using I/O statements
2. Program using Control Statements
3. Program using Arrays
4. Program using Array of objects
5. Program using Functions
6. Program using Classes and Objects
7. Program using Inline Function
8. Program using Friend Function
9. Program using Constructors and Destructors
10. Program using Function Overloading
11. Program using Unary Operator Overloading
12. Program using Binary Operator Overloading
13. Program using String Handling Function
14. Program using Single Inheritance
15. Program using Multiple Inheritance
16. Program using Multi Level Inheritance
17. Program using Pointer to object
18. Program using Virtual Function
19. Program using File Concepts
20. Program using command line arguments

Total Hours: 60

Course outcomes

CO1: Distinguish the procedural and object-oriented paradigm with concepts of streams, classes, functions, data and objects in C++

CO2: Evaluate dynamic memory management techniques in C++ using pointers, constructors, destructors etc

CO3: Describe the concept of function overloading, operator overloading, virtual functions and polymorphism.

CO4: Classify inheritance with the understanding of early and late binding

CO5: Demonstrate the use of various OOPs concepts with the help of programs

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO2	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO3	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO4	H	H	H	H	M	M	H	M	M	L	L	H	M	M
CO5	H	H	H	H	M	M	H	M	M	L	L	H	M	M

Computing Lab II – Relational Database Management System

Semester I **Hours of Instructions / Week: 4**

23MCAC07 **No. of Credits: 3**

Objectives:

1. Perform database operations with DDL, DML, DCL commands.
2. Create and work with database objects.
3. Design and develop oracle applications.

List of Programs

1. Creating and working with tables adding constraints and creating aliases.
2. SQL queries involving date, time operations.
3. Creating indices and range partitions.
4. SQL queries using built in functions, date functions and conversion functions.
5. SQL queries using advanced SQL operators.
6. SQL queries using multiple and correlated Sub queries.
7. SQL queries using Join.
8. Design an oracle application using SQL Statements.
9. Design an oracle application using Built in Functions.
10. Write a PL/SQL block using %type and %row type attributes.
11. Write a PL/SQL block using Conditional statements.
12. Write a PL/SQL block using Cursors.
13. Write a PL/SQL block using Procedures.
14. Write a PL/SQL block using Functions.
15. Write a PL/SQL block using Triggers.
16. Write a PL/SQL block using Exceptions.
17. Write a PL/SQL block using Packages.
18. Design a GUI to implement DML commands.
19. Design a GUI to perform conditional retrieval using data controls.

Total Hours: 60

Course Outcomes:

CO1: Apply DDL, TCL, DML commands for table manipulation.

CO2: Experiment with queries and sub queries using various special operators and built in functions.

CO3: Create database objects, implement entity and domain constraints.

CO4: Manage multiple tables for applications.

CO5: Create appropriate GUI for database applications.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	M	L	L	L	L	-	-	-	-	L	-	M	L	L
CO2	M	L	L	L	L	-	-	-	-	L	-	M	L	L
CO3	M	M	M	L	L	-	-	-	-	L	-	M	L	L
CO4	M	M	M	L	L	-	-	-	-	L	-	M	L	L
CO5	H	H	M	M	M	M	-	-	M	L	-	H	M	L

Optimization Techniques

Semester II **Hours of Instructions / Week: 4**

23MCAC08 **No. of credits: 4**

***Objectives*:**

1. Enable the students to learn and understand the concepts about Linear Programming.
2. Understand the Transportation model, Assignment model, Network Scheduling (PERT/CPM), Replacement policy and Sequencing.
3. Solving Real Life Problems.

Unit I: Linear Programming **-15Hrs**

Introduction to LP formulation, Graphical method for two variable problems, General LPP (Characteristics of General LPP)*, Simplex method I, Simplex method II, Duality and Dual simplex method.

Unit II: Transportation **-12Hrs**

Introduction, (Mathematical Model of Transportation problem)*, Finding an Initial Basic Feasible solution using NWCR, LCEM, VAM. Test for optimality using MODI method.

Unit III: Assignment model **-9Hrs**

Introduction to Assignment problem,(mathematical model of Assignment problem)* , Assignment problem and its solution by Hungarian method.

Unit IV: PERT/CPM **-12Hrs**

Introduction to Network Scheduling, (Basic components)*, Rules for construction of network, rules for Labeling nodes (i,j)/D.R Fulkerson"s rule, Critical Path Analysis. Three time estimates (t_o,t_m,t_p), probability consideration in PERT, distinction between PERT and CPM, application of PERT/CPM.

Unit V: Replacement Policy and Sequencing **-12Hrs**

Replacement Theory: Introduction - Replacement of equipment that deteriorates gradually - Replacement policy when value of money does not change with time - Replacement policy when value of money changes with time - Individual and Group Replacement. **Sequencing**: (Basic Terms)* - Processing n jobs through 2 machines - Processing n jobs through K machines - Problems.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. KanthiSwarup, P.K.Gupta and Manmohan (2019),***"Operations Research"***, Sultan Chand& Sons.
2. P.K.Gupta and Manmohan (2020),***"Problems in OR"***, Sultan Chand &Sons.
3. Hamdy. A.Taha, (2011),***"Operations Research an Introduction"***, Nineth Edition, PHI.
4. Gupta Prem Kumar, Hira D. S Chand (2019),***"Operations Research"***, Sultan Chand &CompanyLtd.
5. Sharma.J.K.(2015),***"Operations Research: Theory and Applications"***, Macmillan India Limited,Ninth Edition.

E-learning Resources:

1. http://cec.nic.in/e- content
2. http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html

Course Outcomes:

CO1: Formulate a real-world problem as a mathematical programming model with application software.

CO2: Solvethelinearproblemsandanalyzethesimplexanddualsimplexprinciples.

CO3: Apply optimality and allocation methods for resources.

CO4: Demonstrate network scheduling concepts and apply critical path analysis and time estimates for real time project completion.

CO5: Apply sequencing algorithm for job scheduling.

CO / PO	PO 1	PO2	PO3	PO4	PO5	PO6	PO 7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	-	L	L	-	L	L	-	M	L	L	L	H	L	L
CO2	-	L	L	-	L	L	-	M	L	L	L	H	L	L
CO3	-	L	L	-	L	L	-	M	L	L	L	H	L	L
CO4	-	L	L	-	L	L	-	M	L	L	L	H	L	L
CO5	-	L	L	-	L	L	-	M	L	L	L	H	L	L

Software Engineering

Semester II **Hours of Instructions / Week: 4**

23MCAC09 **No. of Credits: 4**

Objectives:

1. To study engineering approach to design of a software.
2. To serve as a guide to students while developing software.
3. To emphasize new and important software engineering practices.

Unit I: Concepts of Software Process and Metrics **-12Hrs**

Software engineering - A Layered Technology – A process Framework – The Capability Maturity Model Integration (CMMI) – Process Patterns - Process Assessment – Personal and Team Process Models: Personal Software Process - Team Software Process. Process Technology - Product and Process - Agile Process. (Metrics for Process and Project)*.

Unit II: Agile Process and Software Models **-12Hrs**

Prescriptive Models – The Waterfall Model - Incremental process Models - Evolutionary Process Models: Prototyping –. Agile Process models – Adaptive Software Development (ASD) – Dynamic Systems Development Method (DSDM) – (Scrum - Crystal – Feature Driven Development (FDD) – Agile Modeling)*

Unit III: Software Configuration Management & Requirements Engineering **-12Hrs**

Software Configuration Management – Introduction to SCM – SCM Repository – SCM Process. (The System Engineering Hierarchy - Process Engineering - Product Engineering – System Modeling)*. Requirements engineering Tasks: Inception – Elicitation – Elaboration – Negotiation – Specification – Validation - Requirements Management - Initiating the Requirements Engineering process.**Unit IV: Analysis Model and Design Engineering** **-12Hrs**

Requirements Analysis – Analysis modeling Approaches - (Data Modeling Concepts – Objects Oriented Analysis - Flow oriented modeling)*. Design within the context of Software Engineering –Design Process and Design Quality - Design Concepts: Abstraction – Architecture – Patterns – Modularity - Information Hiding - Functional Independence - Refinement – Refactoring.

Unit V: Testing Strategies, Testing Tactics and Reengineering **-12Hrs**

A Strategic approach to Software Testing: Verification and Validation – Test Strategies for Conventional software – Validation Testing – System Testing. Software Testing Fundamentals - Black Box Testing – White Box Testing – Basis path Testing - Control Structure Testing. (Business Process Reengineering)*.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. R.S.Pressman, (2017), ***"Software Engineering: A Practitioner's Approach"***, Indian Edition,Seventh Edition, Tata McGraw Hill.
2. Ian Sommerville, (2015), ***"Software Engineering"***, Tenth Edition, Pearson Education.
3. Jibitesh Mishra, Ashok Mohanty, (2012), ***"Software Engineering"***, First Edition, Pearson Education.

E-Learning Resources:

1. https://www.tutorialspoint.com/software_engineering/index.htm
2. https://www.javatpoint.com/software-engineering-tutorial
3. https://www.guru99.com/software-engineering-tutorial.html
4. https://www.geeksforgeeks.org/software-engineering
5. https://www.tutorialride.com/software-engineering/software-engineering-tutorial.htm

Course Outcomes:

CO1: Apply the software engineering concepts into the processes of software development.

CO2: Analyze the problem domain and enable the process of SRS, adoption of a suitable software process model

CO3: Design and analysis of modules using DFD, UML diagrams.

CO4: Compare the product and process performance using various metrics.

CO5: Evaluate the system with various testing techniques and strategies.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO 1	PSO 2	PSO 3
CO1	H	H	H	H	M	H	M	H	M	M	H	H	M	H
CO2	H	H	H	H	H	H	M	H	H	H	M	H	L	H
CO3	H	H	H	H	H	M	H	M	M	M	H	H	L	H
CO4	H	H	M	L	H	H	H	M	M	M	M	H	L	H
CO5	M	M	M	M	H	M	H	M	L	M	M	M	M	M

Operating Systems

Semester II **Hours of Instructions / Week: 4**

23MCAC10 **No. of Credits: 4**

Objectives:

1. Acquire knowledge about fundamental concepts of operating systems.
2. Gain knowledge on operating systems resource and techniques to manage them.
3. Understand the need of operating system security and study about few operating systems.

Unit 1: Process Management **-12Hrs**

Introduction to Operating System - Process States - Process State Transition - Process Control Block - Operation on Processes - Suspend and Resume - Interrupt Processing - Nucleus of the Operating System. Deadlock: Four Necessary Conditions for Deadlock - Deadlock Prevention - Deadlock Avoidance and the Banker"s Algorithm - (Deadlock Detection and Recovery)*.

Unit II: Asynchronous Concurrent Processes **-12Hrs**

A Control Structure for Indicating Parallelism - Mutual Exclusion - Critical Sections – Implementing Mutual Exclusion Primitives - Semaphores – Process Synchronization with Semaphores - Counting Semaphores - Implementing Semaphores P and V, (Monitors)*.

Unit III: Storage Management **-12Hrs**

Storage Organization – Storage Management - Storage Hierarchy - Storage Management Strategies - Contiguous and Noncontiguous Storage Allocation - Fixed Partition and Variable Partition Multiprogramming – Multiprogramming with Storage Swapping. Virtual Storage: Basic Concepts - Multilevel Storage Organization - Block Mapping - Paging – (Segmentation)* -Virtual Storage Management Strategies - Page Replacement Strategies.

Unit IV: Processor Management **-12Hrs**

Job and Processor Scheduling – (Scheduling Objectives – Scheduling Criteria)* - Pre-emptive Vs Non Preemptive Scheduling - Priorities - Scheduling Techniques - Distributed Computing: Processor Interconnection Schemes - Multiprocessor Operating System Organization.

Unit V: Auxiliary Storage Management, Performance and Case Studies **-12Hrs**

Disk scheduling – Characteristics of scheduling policies - Seek Optimization – Rotational Optimization. File and Data base systems - Data base models. Performance measures - Evaluation Techniques – Operating System Security - External Security - Operational Security –Surveillance - Threat Monitoring – Amplification - Password Protection – Auditing - Access Controls - (File System of UNIX and Windows Operating Systems)*.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Harvey M.Deital, Paul. J.Deitel, David R.Choffnes, (2004), ***"Operating Systems"***, ThirdEdition, Pearson Publications.
2. Andrew S. Tanenbaum, (2015), ***"Modern Operating Systems"***, Third Edition, Prentice Hall of India.
3. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, (2012), **"Operating System Concepts"**, Ninth Edition, Wiley.

E-Learning Resources:

1. https://easyengineering.net/operating-systems-by-deite/
2. https://www.tutorialspoint.com/operating_system/index.htm

Course Outcomes:

CO1: Analyze various process states and apply deadlock recovery measures.

CO2: Implement mutual exclusion primitives and process Synchronization.

CO3: Organize and manage storage efficiently.

CO4: Organize and manage processors effectively.

CO5: Implement operating system security, protection mechanisms and compare various operating systems.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	M	H	M	M	M	M	L	L	M	M	M	H	L
CO2	H	M	H	M	M	M	M	L	L	M	M	M	H	L
CO3	H	M	H	M	M	M	M	L	L	M	M	M	H	L
CO4	H	M	H	M	M	M	M	L	L	M	M	M	H	L
CO5	H	M	H	M	M	M	H	L	L	M	M	M	H	M

Data Communication and Networks

Semester II **Hours of Instructions / Week: 4**

23MCAC11 **No. of Credits: 4**

Objectives:

1. To understand the fundamental concepts of data communication
2. To learn the functionalities of the layers of networks models
3. To know the applications of computer networks

Unit I: Introduction to Computer Networks and Data Communication Fundamentals -12Hrs

Network Definition, Network Topologies, Network Classifications, Network Protocol, Layered Network Architecture, Overview of OSI Reference Model, Overview of TCP/IP Protocol Suite,(Analog and Digital Signal, Data-Rate Limits) *, Digital to Digital Line Encoding Schemes, Pulse Code Modulation, Parallel and Serial Transmission, Digital to Analog Modulation - Multiplexing Techniques- FDM, TDM, Transmission Media.

UNIT II. Networks Switching Techniques -12Hrs

Circuit Switching, Packet Switching- Connectionless Datagram Switching, Connection- Oriented Virtual Circuit Switching; Dial-Up Modems, Digital Subscriber Line, (Cable TV for Data Transfer) *

UNIT III. Data Link Layer Functions and Protocols -12Hrs

Error Detection and Error Correction Techniques, Data-Link Control- Framing and Flow Control, Error Recovery Protocols-Stop and Wait ARQ, Go-Back-N ARQ, (Point to Point Protocol on Internet) *

UNIT IV. Multiple Access Protocol and Network Layer -12Hrs

CSMA/CD Protocols, Ethernet LANS; Connecting LAN and Back-Bone Networks- (Repeaters, Hubs, Switches, Bridges, Router and Gateways) *, Networks Layer Functions and Protocols, Routing, Routing Algorithms, Network Layer Protocol of Internet - IP Protocol, Internet Control Protocols.

UNIT V. Transport Layer and Application Layer Functions and Protocols -12Hrs

Transport Services- Error and Flow Control, Connection Establishment and Release- Three way Handshake, Overview of Application Layer Protocol. Overview of DNS Protocol; (Overview of WWW & HTTP Protocol) *

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Behrouz A. Forouzan (2022), ***"Data Communications and Networking"***, McGraw Hill Education; sixth edition.
2. Andrew S. Tanenbaum (2022), ***"Computer Networks"***, Pearson Prentice Hall; Sixth Edition.
3. Stallings William (2017), ***"Data and Computer Communication"***, Pearson Education; tenth Edition.

E-Learning Resources:

1. Computer networks, https://nptel.ac.in/courses/106106091

Course Outcomes:

CO1: Explain the layered communication architectures and its functionalities

CO2: Assess the network switching techniques.

CO3: Appraise various error detection & correction techniques and flow control protocols.

CO4: Analyze the MAC and network layer protocols

CO5: Outline the Transport layer and Application layer functions and Protocols

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	H	H	L	M	L	H	L	L	L	H	H	H
CO2	H	H	H	H	L	H	L	H	L	L	L	H	M	H
CO3	M	H	H	M	L	H	L	H	L	L	L	M	H	H
CO4	H	H	M	H	L	H	L	H	L	L	L	H	M	H
CO5	H	H	H	H	L	L	L	H	L	L	L	M	H	H

Data Mining and Warehousing

Semester II **Hours of Instructions /Week: 4**

23MCAC12 **No. of Credits: 4**

Objectives:

1. Introduce the concepts ofdata mining and warehousing.
2. Explain the principles behind processing queries in a data warehouse
3. Give a broad perspective of the different functionalities of Data mining and their applications through case studies

Unit I: Introduction and Basic concepts **-12Hrs**

Concepts of Data Mining – Functionalities – Practical Applications – Pre-processing. Basic Concepts of warehousing– (Steps in the design of the Data Warehouse)* – Schema for multidimensional databases - Three tier architecture -Backend Tools and utilities – OLAP server – Indexing – Computation of Data Cube – (Processing OLAP queries)*.

Unit II: Frequent Pattern Mining, Associations **-12Hrs**

Basic concepts – Association Rule Mining – Apriori and FP growth – Kinds of Association rules – Correlation analysis – Constraint based Association Mining - (Associative Classification)*.

Unit III: Classification and Prediction **-12Hrs**

Issues in Classification – Decision Tree Induction – Naïve Bayesian Classification – Rule based Classification – (Back-propagation)* – Support vector Machines Linear Regression – Non – linear Regression – Accuracy and error measures – Evaluating Accuracy - Ensemble method.

Unit IV: Cluster Analysis **-12Hrs**

Clustering - Types of Data – Partitioning Methods – Hierarchical Methods – Density Based – Model based - Constraint based - Outlier Analysis - (Statistical Distribution based Outlier Detection)*.

Unit V: Mining Complex Data Types and Applications **-12Hrs**

Methodologies for stream data processing – Mining time series data – Trend Analysis – Similarity Search - Text Mining – Mining the www – Application in Financial Data Analysis – Biological Data Analysis – (Graph Mining - Social network Analysis)* – WEKA Tool- exploratory and experimental modules for data preprocessing association, classification, clustering and outlier analysis , BI.

***Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Jiawei Han and Micheline Kamber, (2012), ***"Data Mining Concepts andTechniques"***, Third Edition, Morgan Kaufmann Publishers.
2. Alex Berson, Stephen J. Smith, (2010), ***"Data warehousing, Data Mining, and OLAP"***, Tata McGraw Hill.
3. Ian Witten, Eibe Frank, Mark Hall, Christopher Pal, (2017), ***"Data Mining Practical Machine Learning Tools and Technique"***, Elsevier India.

Course Outcomes:

CO 1: Apply the various steps of the KDD process and apply the relevantpreprocessing techniques in large datasets.

CO 2: Delineate the processes involved in the construction of a data warehouse.

CO 3: Analyze and comprehend the concepts of multidimensional databases.

CO 4: Propose solutions using data mining tools and demonstrate application of association, classification and clustering algorithms

CO 5: Develop strategies for BI and other applications using Weka.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	M	M	H	-	-	L	-	L	H	L	M	H	-
CO2	M	M	M	H	-	-	L	-	L	H	L	M	H	-
CO3	M	M	M	H	-	-	L	-	L	H	L	M	H	-
CO4	M	M	M	H	-	-	L	-	L	H	L	M	H	-
CO5	M	M	M	H	-	-	L	-	L	H	L	M	H	-

Computing Lab III – Python Programming

Semester II **Hours of Instructions / Week: 3**

23MCAC13 **No. of Credits: 2**

Objectives:

1. Understanding the basics of Python
2. Applying data analytics based computation.
3. Implementing machine learning methods using real-world data.

List of Programs

1. Program using control flow statements.
2. Program using anonymous function and user defined function
3. Program to perform string operations
4. Program using concept of List, Tuples and Sets
5. Program related to Dictionaries and Dictionary Comprehensions
6. Programto implement Web Scraping.
7. Program for reducing data dimensionality using PCA.
8. Program to perform correlation analysis.
9. Program for implementing Statistical Hypothesis Testing.
10. Program using cluster Analysis techniques.
11. Program using Linear Regression Analysis.
12. Program using Logistic Regression Analysis.
13. Program to implement Naïve Bayes theorem.
14. Program for SVM Classification.
15. Program using KNN Classification.
16. Program for implementing Back Propagation algorithm.
17. Program for Sentiments analysis
18. Program to perform Time series analysis.
19. Program for handling Deep learning algorithms.
20. Program to display different types of plots using Matplot lib.

Total Hours: 45

Course Outcomes:

CO1: Analyzing the uniqueness of Python as a programming language.

CO2: Relating Python features as a data analysis tool.

CO3: Appraising the various machine learning algorithms supported.

CO4: Experimenting the applications of classification techniques.

CO5: Comparing different types of plots and graphs.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	M	M	M	L	L	-	-	-	-	-	-	M	L	L
CO2	H	H	H	M	M	M	-	-	L	L	L	H	M	M
CO3	H	H	H	M	M	M	-	-	L	L	L	H	M	M
CO4	H	H	H	M	M	M	-	-	L	L	L	H	M	M
CO5	M	M	M	L	L	-	-	-	-	-	-	M	L	L

Accounting and Managerial Decision

Semester III **Hours of instruction /week: 4**

23MCAC15 **No. of credits: 4**

Objectives:

1. To familiarize with the forms of Business organization
2. To learn the principles of financial accounting and cost accounting
3. To understand the importance of Budgeting and Budgetary control

Unit I Business Organisation **-12Hrs**

Business- meaning-objectives, functions, principles of business organization, types of business organization, sole traders, partnership firms, joint stock companies.

Unit II Financial Accountin **-12Hrs**

Meaning, Definition, Need and Scope of Accounting, Book Keeping, Accounting Concepts and Conventions, Double Entry System of Book Keeping. Journal, Ledger, Subsidiary Books, Trial balance, Preparation of final accounts for Sole traders **(Simple problems only)**

Unit III Analysis of Financial Statements **-12Hrs**

Company final accounts as per Companies Act, 2013, Analysis of financial statement, meaning importance , methods, comparative statements , common size statements and ratio analysis, classification of ratios, solvency ratios, profitability ratios, activity ratios, liquidity ratios. **(simple problems only)**

Unit IV Cost Accounting **-12Hrs**

Cost Accounting, Definition, Advantages, difference between Cost Accounting and Financial Accounting, Cost Center, Installation of a Costing System, Classification of Costs, Elements of Cost, Preparation of Cost Sheet, tender. **(simple problems only)**

Unit V Budgeting and Budgetary Control **-12Hrs**

Budget, budgeting and budgetary control, nature, objectives, essentials, advantages, limitations. Types of budget, financial budget, fixed budget, flexible budget, sales budget, cash budget, production budget, material budget, master budget. **(simple problems only)**

Total Hours: 60

Reference Books:

1. Bhushan Y.K. (2016).”***Business Organisation and Management***”, Sultan Chand and Sons, New Delhi.
2. Jain S.P. and Narang.K.L (2019). “***Financial Accounting***”. Kalyani Publishers, New Delhi
3. Jain S.P. and Narang K.L. (2019), “***Cost Accounting***” Kalyani Publishers, New Delhi.
4. Pillai R.S.N. & Bagavathi V, (2017), “***Cost Accounting***” S.Chand & Co., Ltd., New Delhi.
5. Jain S.P. and Narang.K.L (2019), “ ***Management Accounting***” Kalyani Publisher, New Delhi

Course Outcomes:

CO1: Acquisition of knowledge on various forms of business organisation

CO2: Understand the fundamentals elements of financial accounting

CO3: Develop the skill of analyses and interpretation of financial statements

CO4: Gain knowledge on computation of cost of production

CO5: Ability to prepare and forecast budget

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PSO 1	PSO2	PSO3
CO1	H	H	M	M	H	M	L	H	M	-	M	H	H	H
CO2	H	H	M	M	H	M	M	H	M	-	M	H	H	H
CO3	H	H	M	M	H	M	M	H	M	-	M	H	H	H
CO4	H	H	M	M	H	M	M	H	M	-	M	H	H	H
CO5	H	H	M	M	H	M	-	H	M	-	M	H	H	H

Software Project Management

Semester III **Hours of Instructions / Week: 4**

23MCAC16 **No. of Credits: 4**

Objectives:

1. Highlight the importance of software project management.
2. Plan and adopt methodologies for successful development of software projects.
3. Manage people effectively and emphasize the need for software quality.

Unit I: Introduction to Software Project Management and Project Evaluation **-12Hrs**

Project - Software project versus other types of project – Activities covered by software Project management – Some ways of categorizing software projects – What is Management? – Problems with Software Projects – (Management Control, Stakeholders)*.Project Evaluation – (Strategic assessment – Technical Assessment)* – Cost–benefit Analysis – Cash Flow Forecasting – Cost–benefit Evaluation Techniques.

Unit II: Project Planning, Selection of an Appropriate Project Approach and Software Estimation. -12Hrs

Step Wise overview of Project planning - Selection of appropriate project approach - Choosing and methodologies and technologies – Choice of process models– The waterfall model –V-process model –The spiral model – Software Prototyping. Where are estimates done? – Problems with over and under estimation – The basis for software Estimating – Software Estimating Techniques – Expert Judgment– Estimating by Analogy – (Albrecht Function Point Analysis)*.

Unit III: Activity Planning and Risk Management: **-10Hrs**

The Objectives of Activity Planning – When to plan – Project Schedules – (Project and Activities – Sequencing and Scheduling Activities)* – Network Planning Models – Representing lagged activities Adding the time dimension – The Forward pass – Backward pass - Identifying the Critical Path. Risk Management: Risk - Categories of risk – Risk Identification - Risk Assessment – Risk Planning.(Evaluating Risks to the Schedule - Applying the PERT Technique)*.

Unit IV: Resource Allocation, Monitoring and Control & Managing Contracts **-12Hrs**

The Nature of Resources - Identifying Resource Requirements - Scheduling Resources - Creating Critical Paths – Publishing Resource Schedule. Monitoring and Control – Responsibility - Assessing Progress – Setting Checkpoints – Taking Snap-Shots – Collecting the Data – Visualizing Progress. – (Cost Monitoring –Change of Control)*.Types of Contract - Stages in Contract Placement - Contract Management.

Unit V: Managing People in Software Environments and Software Quality **-14Hrs**

Understanding Behaviour – Organizational Behaviour: A Background – Selecting the Right Personfor the job – Instruction in the Best Methods – Motivation – The Oldham – Hackman JobCharacteristics Model – Working in Groups – Becoming a Team – Decision Making – Leadership –Organizational Structures. Software Quality - Importance of Software Quality – Practical Software Quality Measures –External Standards - TQM – (MS Project)*.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Mike Cotterell and Bob Hughes, (2010), ***"Software Project Management"***, Fifth Edition,TATA McGraw-Hill Publications.
2. S. A. Kelkar, (2013), ***"Software Project Management"***, Third Edition, PHI, New Delhi.
3. Dale H. Besterfiled, (2011), ***"Total Quality Management"***, Third Edition, Pearson Education Asia.

Course Outcomes:

CO 1: Manage projects efficiently by evaluating it strategically and technically.

CO 2: Plan overall project, choose appropriate project approach, estimate resources.

CO 3: Plan project schedules and manage risks.

CO 4: Facilitate to monitor & control projects and mange contracts.

CO 5: Manage people and implement quality standards.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO 1	H	H	H	H	H	M	H	H	H	H	M	H	H	H
CO 2	M	M	H	H	H	M	M	M	M	H	M	H	H	M
CO 3	H	M	H	M	H	M	M	M	M	M	M	H	M	M
CO 4	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 5	H	M	H	H	H	M	H	H	H	H	M	H	H	H

Data Science (Open book)

Semester III **Hours of Instructions / Week: 3**

23MCAC17 **No. of Credits: 3**

Objectives:

1. To introduce necessary knowledge of the mathematical foundations needed for data science.
2. To impart programming skills required to build data science applications.
3. To train the students to have understanding on the various Case Studies of Data Science.

Unit I: Introduction **9 Hrs**

Concept of Data Science - Traits of Big data, Data- Wrangling- Feature Engineering- Exploratory Data Analysis, (Web Scraping)*, Analysis vs Reporting.

Unit II: Python Tools and Libraries **9 Hrs**

Toolkits using Python – Mat plot lib, NumPy (Spider), Scikit-learn, NLTK.Visualizing Data - Bar Charts, Line Charts, Scatter plots. (Working with data - Reading Files)*, Scraping the Web, Using APIs, Cleaning and Munging, Manipulating Data, Rescaling, Dimensionality Reduction.

Unit III: Mathematical Foundations **9 Hrs**

Linear Algebra - (Vectors, Matrices)*. Statistics - Describing a Single Set of Data, Correlation, Simpson"s Paradox, Correlation and Causation. Probability - Dependence and Independence, Conditional Probability, Bayes"s Theorem, Random Variables, Continuous Distributions, The Normal Distribution, The Central Limit Theorem. Hypothesis and Inference - Statistical Hypothesis Testing, Confidence Intervals, Phacking, Bayesian Inference.

Unit IV: Machine Learning **9 Hrs**

Overview of Machine learning concepts – Over fitting and train/test splits. (Types of Machine learning – Supervised, Unsupervised)*, Reinforced learning. Cluster Analysis – Partitioning Method, Hierarchical Method, Density Based Method, Grid Based Method. Bayes Theorem, Linear Regression, Logistic Regression, Decision Trees, Analysis of Time Series, Linear Systems Analysis, Nonlinear Dynamics, Rule Induction, Neural Networks, Learning and Generalization, Overview of Deep Learning.

Unit V: Case Studies **9 Hrs**

(Weather Forecasting)*, Stock Market Prediction, Object Recognition, Real time Sentiment Analysis, Financial Frauds.

*** Indicates Self - Study Component**

Total Hours: 45

Reference Books:

1. Joel Grus (2015), ***"Data Science from Scratch: First Principles with Python"***, O'Reilly Media.
2. Chantal D. Larose, Daniel T. Larose (2019), ***"Data Science Using Python and R"***, First Edition, Wiley.
3. Jain V.K. (2018), ***"Data Science and Analytics"***, Khanna Publishing House, Delhi.
4. Jeeva Jose (2020), ***"Introduction to Machine Learning"***,Khanna Publishing House, Delhi.
5. Chopra Rajiv (2018), ***"Machine Learning"***, Khanna Publishing House, Delhi.
6. Jeffrey S. Saltz , Jeffrey M. Stanton (2017),***"An Introduction to Data Science"***, First Edition, SAGE Publications, Inc.
7. Ian Goodfellow, YoshuaBengio and Aaron Courville (2016), ***"Deep Learning"***, MIT Press.
8. Jiawei Han and Micheline Kamber, (2012), ***"Data Mining Concepts and Techniques"***, Third Edition, Morgan Kaufmann Publishers.

E-Learning Resources:

2. https://nptel.ac.in/courses/110106072
3. https://www.geeksforgeeks.org/machine- learning
4. https://www.w3schools.com/python
5. https://www.guru99.com/data-science-tutorial.html
6. http://www.deeplearningbook.org

Course Outcomes:

CO1: Apply Data Collection, Exploration, Cleaning, Munging and Manipulation of a given Data Set

CO2: Develop small applications using Python Toolkits for Data Science.

CO3: Derive and explain the fundamentals of Mathematical foundations needed for Data Science.

CO4: Design and Develop models such as Clustering, Classification and Regression.

CO5: Compare and Analyze different techniques in Data Science for various cases.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	H	H	H	H	M	H	L	M	L	M	M	H	H	M
CO2	H	H	H	H	M	H	L	M	L	M	M	H	H	M
CO3	H	H	H	H	M	H	L	M	L	M	M	H	H	M
CO4	H	H	H	H	M	H	L	M	L	M	M	H	H	M
CO5	H	H	H	H	M	H	L	M	L	M	M	H	H	M

Artificial Intelligence

Semester III **Hours of Instructions / Week: 4**

23MCAC18 **No. of Credits: 4**

Objectives:

1. To learn the basic concepts of Artificial Intelligence
2. To apply Artificial Intelligence methods in real world problem solving
3. To elaborate the concepts of Machine learning and different learning methods

Unit I: Introduction to Artificial Intelligence **-12Hrs**

Introduction to AI- Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized productions system- Problem solving methods – Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraint satisfaction – (Related algorithms, Measure of performance and analysis of search algorithms)*.

Unit II: Knowledge Representation **-12Hrs**

Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-(Structured representation of knowledge)*.

Unit III: Knowledge Inference **-12Hrs**

Knowledge representation -Production based system, Frame based system. Inference – Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning – Certainty factors, Bayesian Theory-Bayesian Network - Dempster – (Shafer theory)*.

Unit IV: Planning and Machine Learning **-12Hrs**

Basic plan generation systems – Strips -Advanced plan generation systems – K strips -Strategic explanations -Why, Why not and how explanations. Learning - Machine learning, (Adaptive Learning)*.

Unit V: Learning **-12 Hrs**

Learning – Forms of Learning, Inductive Learning – Learning Decision Trees – Ensemble Learning. Knowledge in Learning: Logical formulation of Learning – Knowledge in Learning – Explanation based Learning – Learning using Relevance Information. Statistical Learning Method: Learning with complete data – Learning with Hidden variable (EM algorithm)* – Instance based learning. Reinforcement Learning: Passive reinforcement learning –active reinforcement learning – Generalization in Reinforcement learning.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. Kevin Night and Elaine Rich, Nair B., (2017), "***Artificial Intelligence (SIE)***", Third Edition, McGraw Hill.
2. Dan W. Patterson, (2015), "***Introduction to AI and ES***", First Edition, Pearson Education.
3. Peter Jackson, (2007), "***Introduction to Expert Systems***", Third Edition, Pearson Education.
4. Stuart Russel and Peter Norvig, (2010), "***AI – A Modern Approach***", Third Edition, Pearson Education.
5. Deepak Khemani, (2017), "***Artificial Intelligence***", Tata McGraw Hill Education (Reprint).

E-Learning Resources:

1. https://www.britannica.com/technology/artificial-intelligence
2. https://www.ibm.com/COud/learn/what-is-artificial-intelligence

Course Outcomes

CO1: Gets in-depth knowledge of Artificial Intelligence
CO2: Understand knowledge representations and using various techniques
CO3: Understands the concepts of knowledge inferences
CO4: Understand the concept of planning and machine learning in real world
CO5: Familiarize with different methods of learning techniques.

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	M	H	M	H	H	M	M	M	H	H	M	H	M	M
CO 2	M	H	H	H	H	M	M	M	M	H	M	H	M	M
CO 3	M	H	H	H	H	M	M	M	M	H	M	H	H	H
CO 4	M	H	H	H	H	M	M	M	M	H	M	H	H	H
CO 5	M	H	M	H	M	M	M	M	M	M	M	H	M	M

Cyber Security

Semester III **Hours of Instructions / Week: 4**
23MCAC19 **No. of Credits: 3**

Objectives:

1. Highlight the importance of Cyber Security, Security principles, Cyber Security Challenges and Ethical Practices.
2. Classify cyber-attacks, present different vulnerability weaknesses, Intrusions and the methods to handle them.
3. Introduce the learners the fundamentals in the upcoming technologies, forensic investigations, precautions against different frauds and scams and legal implications.

Unit I: Introduction to Cyber Security, Cyber Attacks, Intrusion Handling Methods **12Hrs**

Cyber Security Basics, Security Principles, Cyber Attacks and their Classification, Vulnerability Assessment (Intrusion Detection and Intrusion Prevention Systems)*.

Unit II: Authentication Methods, Standard Models, Smarter Technology, 9HrsSecurity Auditing **12Hrs**

User Authentication Methods, Bio-metric Authentication Methods, Standard Security Models, Virtual Currency-(Block Chain Technology-Security Auditing)*.

Unit III: Security Types **12Hrs**

Information Security-Network Security-Operating System Security, Web Security-E-mail Security-Mobile Device Security-Cloud Security, IoT Security-Cyber Physical System Security-Social Media Security.

Unit IV: Cyber Crimes, Frauds and Forensic Investigations **12Hrs**

Cyber Crimes- Types-Data Frauds, Analysis of Crimes-Human Behavior- Stylometry-Incident Handling, Investigation Methods-Criminal Profiling- Cyber Trails, Digital Forensics-History-Challenges-Branches of Digital Forensics, Digital Forensic Investigation Methods-(Reporting-Management of Evidences)*.

Unit V: Cyber Law, IT Act, other Acts and Amendments **12Hrs**

Cyber Law-Basics-Information Technology Act 2000-Amendments, Evidentiary value of E- mails/SMS, Cyber-crimes and Offences dealt with IPC-RBI Act-IPR in India, Jurisdiction of Cyber Crime, (Creating awareness and Healthy practices)*.

***Indicates Self-study component**

Total Hours: 60

Reference Books:

1. Charles J. Brooks, Philip Craig, Donald Short, (2018) , " ***Cyber security Essentials***", John Wiley and Sons.
2. Lester Evans, "***Cyber security: An Essential Guide to Computer and Cyber Security for Beginners, Including Ethical Hacking, Risk Assessment, Social Engineering, Attack and Defense Strategies, and Cyber warfare***", 2018, John Wiley and Sons.
3. Prof Amit Garg, Dr. Krishan Kumar Goyal, "***Cyber Security***", 2019, Laxmi Publications

E-learning Resource:

1. https://swayam.gov.in/nd2_cec20_cs09/preview

Course Outcomes:

CO 1: Outline the security rudiments, comprehend the Cyber Security challenges and discriminate between different Intrusion handling Methods.

CO 2: Judge and evaluate different biometrics and suggest suitable ones. Analyze the different types of security models, Audit and Assessment processes.

CO 3: Assess different security types and Practice appropriate security mechanisms to minimize the risks

CO 4: Justify the importance of cybercrime investigation in detecting frauds and scams, scrutinize various steps and methods involved in the investigation process and prepare appropriate reports.

CO 5: Prioritize and Explain Legal, Ethical and Privacy issues existing in cyberspace, Recognize different sections of IT Act, its Amendments and other important Acts and Illustrate the jurisdiction of cybercrimes.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	H	M	H	H	M	L	H	L	M	M	M	H	H	M
CO 2	H	H	H	H	M	H	H	L	M	M	M	H	H	M
CO 3	H	M	H	H	M	M	H	L	M	M	M	H	H	M
CO 4	H	M	H	H	M	M	H	L	M	M	M	H	H	M
CO 5	H	M	H	H	M	M	H	L	M	M	M	H	H	M

Computing Lab IV– PHP and MYSQL

Semester III **Hours of Instructions / Week: 4P**

23MCAC20 **No. of Credits: 3**

Objectives:

1. Design and implement static and dynamic websites.
2. Improve problem solving skills using arrays, strings and functions in PHP
3. Retrieve data from a database and present it in a web page using PHP.

List of Programs

1. Create a web page using ordered list, unordered list, definite list and Nested list.
2. Create a web page to display tables using different attributes.
3. Create a webpage using forms.
4. Create a web page with embedded map and hot spot.
5. Create a web page with horizontal and vertical framesets.
6. Create a XML File with an internal DTD and external DTD.
7. Create a XML File with Namespace.
8. Create a XML File with DTD and CSS.
9. Create a XML File with XSLT.
10. Create a XML File with XML Validator.
11. Create a PHP Program to perform String Manipulation.
12. Create a PHP Program using Control Structures.
13. Create a PHP Program for passing arguments using call by value and call by reference.
14. Create a PHP Program using Single–Dimensional Arrays and Multi-Dimensional Arrays.
15. Create a PHP program to change image automatically using switch case.
16. Create a PHP Program to upload image to the server using HTML and PHP.
17. Create a PHP Program using regular expressions.
18. Create a PHP Program using cookies and sessions.
19. Create a PHP program to upload the registration form into database and to update, delete and display the registration form from the database.
20. Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.

Total Hours: 60

Course Outcomes:

CO1: Apply markup languages to design web pages.

CO2: Build well-formed / valid XML document.

CO3: Appraise the basic concepts in PHP like arrays, strings and functions in PHP.

CO4: Create Web application tasks using PHP programs.

CO5: Solve database tasks using the PHP.

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	H	H	H	H	H	H	H	H	H	H	H	H	H	H
CO 2	L	L	L	H	L	L	L	L	L	L	L	H	H	H
CO 3	H	H	H	H	H	H	H	L	H	H	H	H	H	H
CO 4	H	H	H	H	H	H	H	L	H	H	H	H	H	H
CO 5	H	H	H	H	H	H	H	L	H	H	H	H	H	H

Computing Lab V- R Programming

Semester III **Hours of Instructions/Week: 4P**

23MCAC21 **No. of Credits: 3**

Objectives:

1. Develop the basic programming skills in R
2. Able to choose appropriate statistical function to solve various problems
3. Enable students to use Rto conduct analytics on real life data sets

List of Programs

1. Program to perform Vector and Array operations
2. Program to Perform Matrix operations
3. Program using user defined functions
4. Program to perform Data exploration and preprocessing
5. Program to create Data Visualization with Basic Plots
6. Program to create Data Visualization with Advanced Plot
7. Programto perform Correlation Analysis
8. Program to perform Time Series Analysis
9. Programto perform simple Linear Regression Analysis
10. Programto perform Multi Linear Regression Analysis
11. Program to perform Dimensionality Reduction using PCA
12. Programto perform Hypothesis Testing.
13. Programto implement Clustering algorithm
14. Programto build models using different ensembling techniques
15. Program to apply Naïve Bayes Algorithm for Classification
16. Program to apply KNN for Classification
17. Program to apply SVM for Classification
18. Program to apply Decision Tree for Classification
19. Program to apply Random Forest for Classification
20. Program to apply Association Rule Mining

Total Hours: 60

Course Outcomes:

CO1: Construct and execute basic programs in R

CO2: Compare different types of plots and graphs.

CO3: Explore data-sets and identify appropriate statistical tests

CO4: Develop unsupervised and supervised learning techniques for data analytics

CO5: Apply the knowledge of R to solve real life applications

CO/ PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO 1	M	M	M	L	L	-	-	-	-	-	M	M	L	L
CO 2	H	H	H	M	M	M	-	-	L	L	H	H	M	M
CO 3	H	H	H	M	M	M	-	-	L	L	H	H	M	M
CO 4	H	H	H	M	M	M	-	-	L	L	H	H	M	M
CO 5	M	M	M	L	L	-	-	-	-	-	L	L	L	L

Technical Communication

(Self-Study Course)

Semester III **Hours of Instructions /Week: 1**

23MCAC22 **No. of Credits: 4**

Objectives:

1. To impress on the students the essential elements of effective communication.
2. Preparing the students to be effective communicators.
3. To equip students with the basic communication Strategies in different situations.

Unit I: Fundamentals **- 3Hrs**

Stages in Communication – Channels - Nature of Technical Communication – (Types of Communication Skill)* - Organization and Style of Technical Communication.

Unit II: Professional Speaking **-3Hrs**

Job Interviews – Characteristics - Preparation Techniques - Questions and Answering Strategies – (Group Discussions - Presentation Skills)* - Oral Presentation – Planning - Preparing and Organizing your Presentation.

Unit III: Writing Strategies **-3Hrs**

Writing Effective Sentences – Structure (Coherence and Emphasis)*- Using Connectives - Paragraph Writing-Structure - Principles – Unity – Coherence - Developing a Paragraph.

Unit IV: Professional Writing **-3Hrs**

Routine business letters – (Letter writing skills)* - Form and structure - Style and tone. Resume writing and Job application letters - Business memos - Email messages.

Unit V: Reports **- 3Hrs**

Reports - Types and formats - Structure of formal reports - Parts of a report-writing Strategies. (Proposals - Nature and significance)* - Types and structure of formal proposals - Technical articles - Review and research articles - Writing strategies.

*** Indicates Self - Study Component**

Total Hours: 15

Reference Books:

1. M. Ashraf Rizvi, (2008), ***"Effective Technical Communication"***, Tata Mcgraw Hill Company.
2. Krista Van Laan, (2013), ***"The insider's guide to technical writing"***, First Edition, XML Press.

Course Outcomes:

CO 1: Effective presentation and writing skills

CO 2: Improve speaking skills

CO 3: Apply various style of technical communication

CO 4: Draft resume, letters and email with professionalism

CO 5: Proficiency in preparing technical articles, review and research articles

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	-	-	-	-	M	-	L	L	-	M	L	L	L	L
CO2	-	-	-	-	M	-	L	L	-	M	M	L	L	L
CO3	-	-	-	-	L	L	M	M	M	M	M	M	M	M
CO4	-	-	-	-	M	-	L	L	-	M	L	L	L	L
CO5	-	-	-	-	L	L	M	M	M	M	M	M	M	M