Annexure 15.1

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
M.Sc. Computer Science

Two Year Programme

Programme Outcomes

PO1: Illustrate a range of fundamental principles of Computer Science that will provide the basis for future learning and enable themto adapt to the constant rapid development of the field.

PO2: Interpret the knowledge of appropriate theory, practices and tools for the specification, design and implementation.

PO3: Demonstrate competence in the practical art of computing by showing in design an understanding of the practical methods, and using modern design tools competently for complex real-life IT problems.

PO4: Interpret a range of programming languages and tools to develop computer programs and systems that are effective solutions to problems.

PO5: Develop constructively and methodically when exploring ideas, theories and philosophies.

PO6: Apply mathematics, logic, and statistics to the design, development, andanalysis of software systems.

PO7: Reproduce working in teams to build software systems.

PO8: Identify and apply relevant problem-solving methodologies.

PO9: Apply decision making methodologies to evaluate solutions for efficiency, effectiveness and sustainability.

PO10:Develop creative and effective responses to intellectual, professional and social challenges.

PO11: Produce the skill of being a lifelong learner; open, curious, willing to Investigate, and consider new knowledge and ways of thinking.

Programme Specific Outcomes

PSO1: Communicate Computer Science concepts, designs, and solutions effectively and professionally.

PSO2: Apply Computer Science theory and Software development concepts to construct computing-based solutions.

PSO3: To be creators of new knowledge leading to innovation and entrepreneurship employable in various sectors such as private, government and research organizations.

Scheme ofInstruction and Examination

(For students admitted from2023 -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	23MCSC01	Discrete Structures and Optimization Techniques	4	-	3	40	60	100	4
	23MCSC02	Theory of Computation and Compilers	4	-	3	40	60	100	4
	23MCSC03	Data Analytics	4	-	3	40	60	100	4
	23MCSC04	Data Communication and Networks	4	-	3	40	60	100	4
	23MCSC05	Advanced Data Structures and Analysis of Algorithms	4	-	3	40	60	100	4
	23MCSC06	Computing Lab I - Data Structures and Algorithms	-	4	3	40	60	100	3
	23MCSC07	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	23MCSC08	Mobile Communications	5	-	3	40	60	100	4
	23MCSC09	Software Project Management	4	-	3	40	60	100	4
	23MCSC10	Cyber Security	4	-	3	40	60	100	4
	23MCSC11	Artificial Intelligence	4	-	3	40	60	100	4
	23MCSC12	Computing Lab III - Web Programming	-	3	3	40	60	100	2
	23MCSC13	Computing Lab IV – Python Programming	-	3	3	40	60	100	2
	23MCSC14	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	-	-	-	-	-	2
		Professional Certification Courses							2
Internship during Summer Vacation for One Month									
Third Semester									
I	23MCSC15	Embedded Systems	4	-	3	40	60	100	4
	23MCSC16	Cloud Computing	4	-	3	40	60	100	4
	23MCSC17	Data Mining and Warehousing	4	-	3	40	60	100	4
	23MCSC18	Computer Vision and Image Processing	4	-	3	40	60	100	4
	23MCSC19	Soft Computing	4	-	3	40	60	100	4
	23MCSC20A 23MCSC20B 23MCSC20C	**Elective (Open Book)** 1. Machine Learning 2. Internet of Things 3. Software Testing	3	-	3	100	-	100	3
	23MCSC21	Computing Lab V- Mobile Application Development	-	4	3	40	60	100	3
	23MCSC22	Technical Communication **(Self-Study Course)**	1	-	3	100	-	100	4
		Multi-Disciplinary Course	2	-	3	100	-	100	2
II	23MCSC23	Internship	-	-	-	100	-	100	2
Fourth Semester									
I	23MCSC24	Project	30	-	-	100	100	200	8
									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
	23MCSC23	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. **Inter Disciplinary Course – 23MCSI01- Social Computing**
   23MCSI02 - Machine Learning using Excel
2. **Multi Disciplinary 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

Discrete Structures and Optimization Techniques

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

23MCSC01 **No. ofCredits:4**

Objectives:

1. To enable the students to gain knowledge about basic concepts of Matrices & Set Theory.
2. To introduce students to Mathematical logic .
3. To enable the students to learn and understand the concepts about Linear Programming , Network Scheduling (PERT/CPM) , Replacement Policy and Sequencing to Solve Real Life Problems.

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

Types of Matrices - Matrix Operations- Inverse of Matrix – (Properties of Determinants)* – Eigen Values –Matrix inverse using Cayley–Hamilton Theorem. **Sets and Relations**: Set Operations, Representation and Properties of Relations, Equivalence Relations, Partially Ordering.

Unit II: Mathematical Logic **-8Hrs**

Propositional and Predicate Logic, Propositional Equivalences, (Normal Forms)*, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference.

Unit III: Linear Programming **-14Hrs**

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

Unit IV: PERT/CPM **-14Hrs**

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 (to, tm, tp), probability consideration in PERT, distinction between PERT and CPM, application of PERT/CPM.

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

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. RadhaMuthu,T. Santha, (2016), ***"Discrete Mathematics for Computer Science and Applications"***, Kalaikathir Achchagam, Coimbatore.
2. KanthiSwarup, P.K.Gupta and Manmohan (2019), ***"Operations Research"***, Sultan Chand & Sons.
3. P.K. Gupta and Manmohan (2020),***"Problems in OR"***, Sultan Chand & Sons.

E-Learning Resources:

1.http://www.nptelvideos.in/2012/12/fundamentals-of-operations-research.html.

Course Outcomes:

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

CO2: Apply proving techniques for Rules of Inference

CO3: Formulate a real-world problem as a mathematical programming model with applications

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

CO5: Apply sequencing algorithm for job scheduling.

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

Theory of Computation and Compilers

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

23MCSC02 **No. of Credits: 4**

Objectives:

1. To introduce the concepts of formal languages and types of grammars
2. To explain the phases of compilers.
3. To provide an insight into various techniques of parsing, optimizing and code generation.

Unit I: Introduction to Formal Languages and Grammars **-12 hrs**

Formal language and regular language models-Introduction to Compilers - Definition of Grammars – Types- (Derivation of Sentences – Languages)* - Construction of Grammars -Regular Expressions- Turing machines and its variations.

Unit II: Lexical and Syntax Analysis **-12 hrs**

Role of a lexical analyzer - Finite Automata - Construction of Finite Automata from Regular Expressions - Minimizing the Number of States – (Parse trees - Leftmost and rightmost Derivations - Bottom up and Top down parsing)* - Shift Reduce Parsing - Operator Precedence Parsing - Precedence Functions.

Unit III: Parsing Techniques **-12 hrs**

Making grammars suitable for top down parsing – (Left recursion - Left factoring - Recursive descent parsers - Predictive parsers)* - LR grammars - LR parsing methods – SLR - Canonical LR - LALR methods of parsing - Construction of Closure - Go to functions for the above methods - Construction of parsing tables.

Unit IV: Intermediate Code Generation and Symbol tables **-12 hrs**

Three address codes, triples - Quadruples , syntax trees -data structures for symbol tables. Lists, (self organizing Lists, tress)*- hash tables.

Unit V: Code optimization and Code Generation **-12 hrs**

Sources of Optimization - DAG Representation - Problems in Code Generation – Register Allocations and Assignments – (Code Generation Algorithm - Peephole Optimization)*.

*** Indicates Self- Study Component**

Total Hours: 60

Reference Books:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffery, D. Ulman, (2013), ***"Compilers - Principles, Techniquesand Tools"***, Pearson Education.
2. Tremblay, Sorenson, (2002), ***"Theory and Practice of Compiler Writing"***, McGraw Hill Publishing Co.
3. Rajkumar Y Sudha Rani S, Karthi M, (2019), ***" Compiler Design"***, Wiley..
4. Basavaraj S. Anami ,Karibasappa. K.G(2012) , ***" Formal Languages and AutomataTheory"***, Wiley Publications
5. John E .Hopcroft, Rajeev Motwani, Jeffrey D. Ullmann(2009). ***"Introduction to Automata Theory Languages and computation"***, Pearson Education, III Edition.

E-Learning Resources:

1. https://www.tutorialspoint.com/automata_theory/index.htm
2. https://www.tutorialspoint.com/compiler_design/index.htm

Course Outcomes:

CO1: Acquire the knowledge to relate and apply grammars and finite automatons in recognizing languages.

CO2: Explain the phases of compiler design and their respective functions.

CO3: Comprehend the various phases of compiler design and use of appropriate parsing techniques.

CO4: Implement techniques of code generation and optimization in the design of a compiler.

CO5: Evaluate and apply error detection techniques in the design of compilers.

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

Data Analytics

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

23MCSC03 **No. of Credits: 4**

Objectives:

1. To enable the students to gain knowledge in Data Exploration and VisualizationTechniques and practice the same using R.
2. To introduce the various Statistical Techniques and Tests and practice the same.
3. To highlight on the various Machine Learning Techniques.

Unit I: Data Exploration and Visualization **- 12 Hrs**

Introduction of Data Analytics - Data Collection and Management – Sources of Data, Data Collection and APIs, Exploring and Fixing data, Data Storage and Management, Using Multiple Data Sources. Basic Visualization – Pie Chart, Bar Chart, Histograms, Line Chart -Q Plot, Box and Whisker Plot, Dot Chart, Bubble Plot, Image Plot, Mosaic Plot. Advanced Visualization – Scatter Plot, Corrgrams, Tree Maps, Heat Maps, Advanced graphics using ggplot2–(Exploratory Data Analysis on Iris Dataset using R Programming)*

Unit II: Inferential and Descriptive Statistics **- 12 Hrs**

Measures of Central Tendency, Measures of Dispersion, Quantile, Rank, Skewness and Kurtosis, Normal Distribution, Binomial Distribution –(Analytics on Student Mark sheet using Descriptive Statistics in R Tool)*

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

Correlation Analysis – Coefficient of Correlation, Co-efficient of Covariance. Regression Analysis – Simple Linear Regression, Multiple Linear Regression, Logistic Regression-(Stock Market Price Prediction using Regression Analysis using R Tool.)*

Unit IV: Tests of Significance **-12 Hrs**

Statistical Hypothesis Generation and Testing, Chi-Square Test, t-Test, Analysis of Variance –One Way, Two Way–(Implementation of Hypothesis Testing on Mobile Dataset.)*

Unit V: Machine Learning **- 12 Hrs**

Factor Analysis, Principal Component Analysis, k-Means Clustering, Hierarchical Clustering, Naïve Bayes Algorithm, k-Nearest Neighbor's Algorithm, Decision Trees, Support Vector Machines, Random Forest, XG Boost, Association Rule Mining-(Building predictive Model using Machine Learning for Employee Attrition and Performance Appraisal in an Organization.)*

*** Indicates Self- Study Component**

Total Hours: 60

Reference Books:

1. Bharti Motwani (2019), "***Data Analytics with R***", First Edition, Wiley Publications
2. G. Sudhamathy, C. Jothi Venkateswaran, (2018), "***R Programming – An Approach toDataAnalytics***", First Edition, MJP Publishers.
3. S.P. Gupta (2017), "***Statistical Methods***", Forty Fourth Revised Edition, SultanChandand Sons, New Delhi.
4. Anil Maheshwari, "***Data Analytics Made Accessible***" (2023), Kindle Edition.

E-Learning Resources:

1. https://nptel.ac.in/courses/110/107/110107092/
2. https://nptel.ac.in/courses/110107095/
3. http://www.rdatamining.com/docs/data-exploration-and- visualization-with-r
4. https://www.tutorialspoint.com/r/index.htm
5. https://www.guru99.com/r-tutorial.html

Course Outcomes:

CO1: Apply the data exploration and visualization techniques

CO2: Analyze the inferential and descriptive statistical measures

CO3: Evaluate Correlation and Regression measures

CO4: Inference on the Effect of Demographics on suitable applications using various Tests of significance

CO5: Develop Models using Machine Learning Techniques on suitable cases

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PS O1	PS O2	PS O3
CO1	H	H	M	L	M	M	L	M	-	M	M	H	M	M
CO2	H	H	M	L	M	M	L	M	-	M	M	H	M	M
CO3	H	H	M	L	M	M	L	M	-	M	M	H	M	M
CO4	H	H	M	L	M	M	L	M	-	M	M	H	M	M
CO5	H	H	M	L	M	M	L	M	-	M	M	H	M	M

Data Communication and Networks

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

23MCSC04 **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 **-12 Hrs**

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 **-12 Hrs**

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 **-12 Hrs**

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 **-12 Hrs**

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 **-12 Hrs**

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	M	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	M	H	M	H
CO5	H	H	H	H	L	L	L	H	L	L	M	M	H	H

Advanced Data Structures and Analysis of Algorithms

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

23MCSC05 **No. of Credits: 4**

Objectives:

1. To introduce the basic concepts of algorithm analysis, an overview of basic data structures and follows it up with advanced structures.
2. To give an insight on the applications based on advanced data structures.
3. To provide a broad perspective of different design techniques and their analysis.

Unit I: Introduction **-12 Hrs**

Algorithms- analysis-best case - worst case - average case complexities- Big "oh, Theta and Omega notations- (analyzing control structures)*-amortized analysis.

Unit II: Data structures and ADT"s **-12 Hrs**

List – Stacks – Queues - Priority queues - Trees- traversals- Binary trees - Search trees -AVL trees, B-trees - B+trees– Graphs – (Applications using stacks)*.

Unit III: Graph algorithms **-12 Hrs**

Definition and representations - Shortest path algorithms-Dijkstra's , Al pairs -Network flow problems - Minimum spanning tree –Prims -Kruskal's algorithms – (Depth first and Breadth first applications)*.

Unit IV: Sorting and file structures **-12 Hrs**

Insertion sort, Shell sort, Heap sort, Merge sort, Quick sort- Analysis –Establishing lower bounds- External sorting- Model for external sorting – Multiway - Polyphase sorting - Direct files - Indexed sequential files - External searching – Hashing- Virtual, Linear –(ISAM)*, VSAM.

Unit V: Design techniques and computational complexity **-12 Hrs**

Greedy Algorithms- Divide and Conquer-Dynamic programming- Probabilistic algorithms- (Parallel Algorithms)*- Introduction to NP completeness- classes P and NP- P versus NP-NP complete and NP hard problems- polynomial time reductions .

*** Indicates Self- Study Component**

Total Hours: 60

Reference Books:

1. Anany Levitin "Introduction to the Design and Analysis of Algorithms" Pearson Education,2015.
2. Harsh Bhasin, "Algorithms Design and Analysis", Oxford University Press 2015.
3. Gilles Brassard, "Fundamentals of Algorithms", Pearson Education 2015.

E-Learning Resources:

1. https://www.tutorialspoint.com/data_structures_algorithms/index.htm
2. https://www.cs.unm.edu/~saia/classes/561-f09/

Course Outcomes:

CO1: Develop ability to analyze the algorithms and algorithm correctness.

CO2: Construct abstract data types.

CO3: Implement standard operations on various tree and graph data structures and apply the advanced data structures to real world problems.

CO4: Deploy sorting and search algorithms and analyze their computational complexities

CO5: Categorize problems based on computational and complexity theory.

CO/ PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PSO 1	PSO 2	PSO 3
CO1	H	M	H	L	L	-	L	H	-	-	H	M	M	L
CO2	H	M	M	L	L	-	M	H	L	-	H	M	-	-
CO3	H	H	M	L	L	-	M	H	M	-	H	M	L	L
CO4	H	H	M	L	L	-	M	H	M	-	H	M	M	-
CO5	H	L	L	L	L	-	L	L	-	-	H	L	L	-

Computing Lab I - Data Structures and Algorithms

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

23MCSC06 **No. of Credits: 3**

Objectives:

1. To implement operations on data structures
2. To develop and implement various algorithms.
3. To learn and develop applications using various data structures

List of Programs

1. Implement Stacks Operations
2. Implement Queue Operations – Insertion and Deletion
3. Implement singly, doubly and circular linked lists
4. Program to implement copy of a linked list to another.
5. Represent a polynomial as a linked list and write functions for polynomial addition and subtraction.
6. Implement stack and use it to convert infix to postfix expression and vice versa
7. Implement Selection and Insertion sort.
8. Program to implement Quick sort.
9. Implement an expression tree. Produce its pre-order, in-order, and post order traversals.
10. Program to implement Linear and Binary search
11. Program to Multiply two Matrices using Divide And Conquer Algorithm
12. Program to implement Tower Of Hanoi Algorithm Using Recursion
13. Program to implement Knapsack Problem
14. Program to implement Prim's Algorithm
15. Program to implement Kruskals Algorithm
16. Program to implement Traveling salesman algorithm
17. Program to implement Greedy Algorithm to find the shortest path
18. Dijkstra's Algorithm for finding All pairs shortest paths in graphs
19. Program to implement recursive back tracking Algorithm for 8 Queen problem
20. Program to implement Depth First and Breadth First Search

Total Hours: 60

Course Outcomes:

CO1: Analyze the time and space efficiency of the data structure.

CO2: Design linear data structures stacks, queues and linked lists.

CO3: Propose nonlinear data structures trees and graphs, and implement their operations.

CO4: Determine and Implement the appropriate data structure for a given problem.

CO5: Develop practical knowledge on the applications of data structures.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PS O1	PS O2	PS O3
CO1	M	M	M	L	L	M	L	L	M	-	-	M	M	L
CO2	M	M	M	L	L	M	L	L	M	-	-	M	M	L
CO3	M	M	M	L	L	M	L	L	M	-	-	M	M	L
CO4	M	M	M	L	L	M	L	L	M	-	-	M	M	L
CO5	M	M	M	L	L	M	L	L	M	-	-	M	M	L

Computing Lab II – Relational Database Management System

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

23MCSC07 **No. of Credits: 3**

Objectives

1. To perform database operations with DDL, DML, DCL commands.
2. To create and work with database objects.
3. To design and develop oracle applications.

List of Programs

1. SQL queries using DDL, DML, DCL commands & creating aliases
2. SQL queries basics involving date time operations
3. Creating indices and range partition on tables
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. Creating database objects in SQL
9. Design an oracle application using SQL Statements
10. Design an oracle application using Built in Functions
11. Write a PL/SQL block using %type and %row type attributes
12. Write a PL/SQL block using Conditional statements
13. Write a PL/SQL block using Cursors
14. Write a PL/SQL block using Procedures
15. Write a PL/SQL block using Functions
16. Write a PL/SQL block using Triggers
17. Write a PL/SQL block using Exceptions
18. Write a PL/SQL block using Packages
19. Design a GUI to implement DML commands
20. 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 andbuilt 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	PSO1	PSO2	PSO3
CO1	M	L	L	L	L	-	-	-	-	-	-	M	L	-
CO2	M	L	L	L	L	-	-	-	-	-	-	M	L	-
CO3	M	L	L	L	L	-	-	-	-	-	-	M	L	-
CO4	M	L	L	L	L	-	-	-	-	-	-	M	L	-
CO5	H	M	M	L	L	-	M	-	M	-	L	H	M	M

Mobile Communications

Semester II **Hours of Instructions / Week: 5**

23MCSC08 **No. of Credits: 4**

Objectives:

1. To explain the principles of wired and wireless communication.
2. To discuss the layer wise support to wireless network.
3. To introduce various wireless communication techniques.

Unit I: Introduction to Mobile Communications and Wireless Transmission -15 Hrs

History- Applications- Comparison of common wireless systems- Simplified Reference Model - Wireless Networking- Basic Concepts - Cellular Systems- Wireless Transmission : Working of cellular phones - Cell Splitting - frequency reuse – channel assignment strategies - handoff strategies - Signal Propagation- Multipath Propagation - Fading -(Frequencies for radio Transmission- Spread spectrum Technique- Multiplexing- Basic Propagation Mechanism)*.

Unit II: Medium Access Control and Telecommunications Systems -15 Hrs

Motivation for Specialized MAC- Hidden and exposed Terminals- Near/ Far Effect - MAC Algorithms- SDMA- FDMA- TDMA- CDMA- (Telecommunication Systems :1G- 2G- 2.5G- 3G Cellular Networks (GSM)-4G networks and Other Standards)*.

Unit III: Satellite Systems- Cellular Systems and Broadcast System -15 Hrs

Satellite Systems: History- Applications- Basics- Routing- Localization- Handover- (Broadcast Systems: Overview- Cyclic Repetition of Data- Digital Audio Broadcasting- Digital Video Broadcasting)*.

Unit IV: Wireless LAN and Mobile Network Layer -15 Hrs

Wireless LAN: Infra-red Vs radio transmission- Infrastructure and ad-hoc network- IEEE 802.11- 802.11 series- Bluetooth- (Mobile Network Layer : Mobile IP- Dynamic host configuration protocol- Mobile ad hoc networks)*

Unit V: Mobile Transport Layer and Future of Mobile Communication -15 Hrs

Mobile transport Layer: Traditional TCP- Classical TCP Improvements - TCP over 2.5/3G Wireless Networks- Performance Enhancing Proxies- (Future of Mobile Communications: Applications- Future Mobile Computing- Bluetooth- Mobile Commerce)*.

*** Indicates Self - Study Component**

Total Hours: 75

Reference Books:

1. Jochen Schiller, (2006), ***"Mobile Communication"***, Second Edition, Pearson Education Ltd.
2. Theodore S.Rappaport, (2012), ***"Wireless Communication Principles andPractice"***, Pearson Education Pvt Ltd.

Course Outcomes:

CO1: Distinguish the various generations of mobile communications and conceptof cellular communication in wireless technologies.

CO2: Explain GSM mobile communication standard, its architecture, logical channels, advantages and limitations.

CO3: Appraise on current mobile standards and their comparison with earlier technologies.

CO4: Categorize among various Wireless LANs.

CO5: Design and develop the basic principles and applications offuture Mobile communications standards and applications.

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

Software Project Management

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

23MCSC09 **No. of Credits: 4**

***Objectives*:**

1. To highlight the importance of software project management.
2. To enable the learners to understand the methodologies to be adopted for successful development of software projects.
3. To manage people and assure software quality.

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

Project - Software Project versus other types of project – Activities covered by software Project management – Some ways of categorizing software projects – The project as a system-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 **-12 Hrs**

Step Wise overview of Project planning - Step 0: Select project – Step 1: Identify ProjectScope and Objectives – 2: Identify Project Infrastructure – 3: Analyze Project Characteristics-4: Identify Project Products and Activities – 5: Estimate Effort for each activity – 6: Identify Activity Risks – 7: Allocate Resources – 8: Review / Publicize plan– 9: Execute Plan –10: Lower Levels of Planning. Selection of appropriate project approach - Choosing and methodologies and technologies – Choice of process models – Structured methods – The waterfall model –V-process model – The spiral model – (Software Prototyping – other ways of categorizing prototypes)*.

Unit III: Software Estimation and Risk Management: **-12 Hrs**

Where are estimates done? – Problems with over and under estimates – The basis for Software estimating – Software estimating techniques – Expert Judgments – Estimating by Analogy– (Ablrecht Function Point Analysis)*. Risk Management – Risk - categories of risk -Risk Identification- Risk Assessment – Risk Planning. (Evaluating risks to the schedule-Applying the PERT technique)*.

Unit IV: Activity Planning and Monitoring and Control **-12 Hrs**

The objectives of activity planning – When to plan – Project schedules – Project andActivities – Sequencing and scheduling activities – Network planning models – Setting dummy activities – Representing lagged activities – Adding the time dimension – The forward pass- Backward pass - (Identifying the Critical Path - Identifying Critical Activities)*. Monitoring and control – Responsibility - Assessing Progress – Setting Checkpoints – Taking snap-shots – Collecting the data – Visualizing progress – Cost Monitoring – (Prioritizing Monitoring – Change of control)*.

Unit V: Managing People in Software Environment, Working in Teams **-12Hrs**

Understanding Behaviour – Organizational Behaviour: A Background – Selecting the Right person for the job – Instruction in the best methods – Motivation – The Oldham – Hackman job characteristics model – Working in groups – Becoming a team – Decision Making – Leadership – Software Quality - (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, NewDelhi.
3. R.S.Pressman, (2010), ***"Software Engineering, a Practitioner's Approach"***, Seventh Edition, Tata McGraw Hill.

***E-Learning Resource*:**

1. https://idoc.pub/download/mcgraw-hill-software-project-management-second-editionpdf-d49o5rk6m849
2. https://www.opentextbooks.org.hk/system/files/export/15/15694/pdf/Project_Manag ement_15694.pdf
3. https://www.tutorialspoint.com/management_concepts/project_management_processes.htm

Course Outcomes:

CO1: Manage and evaluate projects effectively.

CO2: Develop, execute project plans and Choose appropriate methodologies and technologies.

CO3: Estimate resources and manage risks.

CO4: Plan activities, monitor and control projects.

CO5: Manage people in software environment.

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PS O1	PS O2	PS O3
CO1	H	H	H	H	M	M	M	H	H	L	M	H	H	M
CO2	H	H	H	H	M	M	M	H	H	L	M	H	H	L
CO3	H	H	H	H	M	M	M	M	M	L	M	H	H	L
CO4	H	H	H	H	M	M	M	M	M	L	M	H	H	L
CO5	H	H	H	H	M	M	H	M	M	L	M	H	H	L

Cyber Security

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

23MCSC10 **No. of Credits: 4**

***Objectives*:**

1. To highlight the importance of Cyber Security, Security principles, Cyber Security Challenges and Ethical Practices.
2. To classify cyber-attacks, present different vulnerability weaknesses, Intrusions and the methods to handle them.
3. To 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 -12 Hrs

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, Security Auditing -12 Hrs

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

Unit III: Security Types -12 Hrs

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 -12 Hrs

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

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 ofCyber Crime, (Creating awareness and Healthy practices)*.

*** Indicates Self-study components**

Total Hours: 60

***Reference Books*:**

1. **Charles J. Brooks, Christopher Grow, Philip CraigDonald Short,*"CybersecurityEssentials"*, (2018), 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 Wileyand Sons.
3. Prof AmitGargDrKrishan Kumar Goyal, ***"Cyber Security"***, 2019,Laxmi Publications

***E-Learning Resource*:**

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

Course Outcomes:

CO1: Outline the security rudiments, comprehend the Cyber Security challenges and discriminate between different Intrusion handling Methods.

CO2: Judge and evaluate different biometrics and suggest suitable ones. Analyze the different types of security models, Audit and Assessment processes.

CO3: Assess different security types and Practice appropriate security mechanisms to minimize the risks

CO4: 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.

CO5: 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 ofcybercrimes.

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

Artificial Intelligence

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

23MCSC11 **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

Computing Lab III – Web Programming

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

23MCSC12 **No. of Credits: 2**

Objectives:

1. Introduce the design and implementation of static and dynamic websites.
2. Introduce problem solving skills using arrays, strings and functions in PHP
3. To 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 web page 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 Name space.
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 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: 45

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: Analyze and solve common Web application tasks using PHP programs.

CO5: Analyze and solve database tasks using the PHP language.

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

Computing Lab IV– Python Programming

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

23MCSC13 **No. of Credits: 2**

Objectives:

1. To understand the basics of Python as a programming language.
2. To apply data analysis oriented computation.
3. To implement 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. Program to 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 using KNN Classification.
15. Program for applying Decision tree.
16. Program for implementing Back Propagation algorithm.
17. Program for Sentiment analysis.
18. Program to perform Time series analysis.
19. Program for handling Deep learning algorithms.
20. Program to display different types of plots using Matplotlib.

Total Hours: 45

Course Outcomes:

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

CO2: Relate Python features as a data analysis tool.

CO3: Apply different machine learning algorithms supported.

CO4: Experiment with Deep learning algorithms.

CO5: Compare different Compare different types of plots and graphs.

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

Embedded Systems

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

23MCSC15 **No. of Credits: 4**

Objectives:

1. To gain knowledge and understanding of fundamental embedded systems design paradigms, architectures, possibilities respect to both software and hardware.
2. To impart deep state-of-the-art theoretical knowledge of learning systems, sensor and measuring systems in their interdisciplinary nature for integrated hardware and software systems.
3. To prepare the students to meet the challenges in areas of technology, especially from computer engineering, robotics and electronics.

Unit I: Introduction to Embedded Systems **-12 hrs**

Basis of Embedded System - Applications of ES - Examples of ES - Electricals Components - Voltage – Current - Ohm"s Law - Kirchoff's law - Voltage divider rule - Current divider rule – AC & DC – Electronic Components - Resistors – Capacitors – Inductors - Transistors (NPN & PNP) - Transistor act as a Switch & Amplifier - Logic Gates (AND, OR, NOT, etc.) - MUX- De-MUX- Flip-flop"s – (Memory - RAM- ROM-EEPROM-FLASH)*.

Unit II: Microprocessors & Micro controllers **-12 hrs**

Introduction to Microprocessors & Applications - 8-Bit Microcontrollers – Architecture - Block diagram -Instruction set - Addressing Modes – Memory – Peripherals - I/O Ports - Timers – ADC - Serial Ports –PWM - Microcontroller Source & Sink circuit design – Difference between Microprocessor & Microcontroller- (ARM Processors)*.

Unit III: Embedded System Design **-12 hrs**

Introduction to Embedded systems – Challenges - Embedded system design considerations and requirements - Processor selection - Overview of IoT Hardware platforms - Raspberry pi - ARM Cortex Processors - Arduino boards - Communication System – Serial Communications – UART – I2C – SPI – Communication modules – Bluetooth module – Zigbee communication module – Wi-Fi Module – GSM module.

Unit IV: Embedded System Development **-12 hrs**

Basic Software Components – Assemblers – Compilers - Cross Compilers – Linkers – Locators – Software development cycle – Supported Languages - Embedded C, C++ - JAVA - PYTHON – Arduino IDE – Library files – Basic of Arduino Application - Sensor Technologies – Classification of Sensors – Types of Sensor – IR – RFID – Temperature – Biosensors – Ultrasonic – PIR – Field of Applications & Different Sensors Used – Sensor interfacing with Arduino Board.

Unit V: Embedded System Applications **-12 hrs**

LED Blinking with Arduino – Smart Traffic Lights – Weather monitoring system using DHT11 Sensor & LCD display – Object Detector using Ultrasonic Sensor - Door Locking System using RFID - Internet of Things - Thinkspeak– Robotics.

*** Indicates Self Study Component**

Total Hours: 60

Reference Books:

1. ***David E Simon, (2005), "An embedded software primer",*** Pearson education Asia.
2. ***Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey, (2016), "PIC Microcontroller andEmbedded Systems using Assembly and C for PIC18",*** Pearson Education Hall Inc., New Jersey.
3. ***Marilyn Wolf, (2017), "Computers as Components: Principles of Embedded Computer SystemsDesign",*** Amsterdam ; Boston : Elsevier/Morgan Kaufman Publishers.
4. ***Neerparaj, (2018), "Arduino Projects for Engineers: A Multipurpose Book for All EngineeringBranches",*** BPB publications, India

Course Outcomes:

CO1: Learn fundamentals of Embedded System.

CO2: Gain good knowledge on microcontrollers and implement in practical applications

CO3: Understand about the microcontroller and communication systems

CO4: Ability to write the programs for microcontroller and interface with the sensor technology

CO5: Ability to design and conduct experiments as well as to organize, analyzeand interpret data on multidisciplinary domains onto role of electronics and computer science.

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	M	-	M	-	M	-	M	M	M	-	-
CO 2	H	H	H	M	-	M	-	M	-	M	M	M	-	-
CO 3	H	H	H	H	-	M	-	M	-	H	M	M	-	-
CO 4	H	H	H	H	H	H	-	M	H	H	M	M	H	-
CO 5	H	H	H	H	H	H	-	M	H	H	M	M	H	-

Cloud Computing

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

23MCSC16 **No. of Credits: 4**

Objectives:

1. To understand the basic concepts of cloud computing.
2. To familiarize with the various cloud service and deployment models.
3. To acquire knowledge on cloud management and security issues.

Unit I: Introduction to Cloud Computing **-12 Hrs**

Introduction to Cloud Computing, Benefits and limitations of Cloud Computing, Comparison of cloud computing with other computing paradigms: Cloud computing vs. Cluster computing vs. Grid computing, (Cloud Infrastructure Management) *, seven step model to migrate into the cloud

Unit II: Cloud Computing Architecture **-12 Hrs**

Cloud Computing Architecture, Services provided at various levels, Service Models- Infrastructure as a Service(IaaS), Platform as a Service (PaaS), Software as a Service(SaaS), Deployment Models- Public cloud, Private cloud, Hybrid cloud, Community cloud, (NIST architecture)*.

Unit III: Service Level Management, Cloud Storage and Mobile cloud computing -12 Hrs

Service Level Agreements (SLAs), Types of SLA, Life Cycle SLA, SLA management in cloud, Advantages of cloud storage, Cloud storage providers-S3, (Cloud economics) *, Mobile Cloud Computing: Evolution of Mobile Computing , Mobile Cloud Ecosystem , Mobile Players

Unit IV: Cloud Security **-12 Hrs**

Security Overview, Cloud Security Challenges, Infrastructure Security, Network level security, Host level security, Application-level security, Jurisdictional issues raised by virtualization and location, Data security in the cloud, (Data privacy and security Issues)*, Authentication in cloud computing.

Unit V: Cloud Advancements **-12 Hrs**

Google App Engine, Programming Environment for Google App Engine, Federation in the Cloud -Four Levels of Federation, Federated Services and Applications, (Future of Federation) *

*** Indicates Self Study Component**

Total Hours: 60

Text Books:

1. ***Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, (2010),*** *CloudComputing: Principles and Paradigms, Wiley.*
2. ***Ronald L. Krutz, Russell Dean Vines, (2010),*** *Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Wiley-India.*
3. ***Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, (2011), CloudComputing:Principles and Paradigms,*** Wiley.
4. ***Ronald L. Krutz, Russell Dean Vines, (2010), Cloud Security: A Comprehensive Guide toSecure Cloud Computing, Wiley-India.***

E-learning Resources:

1. https://swayam.gov.in/courses/3742-cloud-computing
2. http://www.serc.iisc.ernet.in/~jlakshmi/Research/CloudsandQoS/Cloud%2 0Computing-BirdsEyeView-Oct2011.pdf
3. https://swayam.gov.in/courses/3742-cloud-computing
4. http://www.serc.iisc.ernet.in/~jlakshmi/Research/CloudsandQoS/Clo ud%2 0Computing-BirdsEyeView-Oct2011.pdf

Course Outcomes:

CO1: Understand the cloud computing paradigm and its importance.

CO2: Become familiar with cloud architecture and services and deployment models.

CO3: Become Familiar with Service Level Agreements and Cloud Storage.

CO4: Adequate knowledge on cloud security.

CO5: Explore advancements in cloud technologies

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

Data Mining and Warehousing

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

23MCSC17 **No. of Credits: 4**

***Objectives*:**

1. To introduce the concepts of data mining and warehousing.
2. To explain the various Data mining functionalities and the techniques.
3. To apply the knowledge of various functionalities using Weka.

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

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 **-12 Hrs**

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 **-12 Hrs**

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 **- 12 Hrs**

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 **-12 Hrs**

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 pre processing association, classification, clustering and outlier analysis.

*** Indicates Self- Study Component**

Total Hours: 60

Reference Books:

1. Jiawei Han, MichelineKamber, Jian Pei. (2012), ***"Data Mining Conceptsand Techniques"***, Morgan Kaufmann Publishers.
2. AleaBeasen, S.J.smith (2010), ***"Data Warehousing, Data Mining and OLAP"***, TataMcGraw Hill.

E-Learning Resource:

1. https://www.tutorialspoint.com/data_mining/data_mining_tutorial.pdf 2. https://nptel.ac.in/courses/106/105/106105174/

Course Outcomes:

CO1: Apply the various steps of the KDD process and apply the relevant pre processing techniques in large datasets

CO2: Delineate the processes involved in the construction of a data warehouse

CO3: Apply data mining tools to demonstrate association, classification and clustering using different algorithms.

CO4: Differentiate and choose appropriate functionalities to solve specific needs.

CO5: Relate and apply and implement the various Data Mining functionalities to specific areas like financial data and biological data, using Weka,

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

Computer Vision and Image Processing

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

23MCSC18 **No. of Credits: 4**

Objectives:

1. To provide knowledge in basic image processing and recognition.
2. To impart knowledge to develop a real time application.
3. To train on Image enhancement and analysis and extract features.

Unit I: Image Formation and Digitization **-12 Hrs**

What is Digital Image Processing? Example of Fields that use Digital Image Processing - Fundamental Steps in Digital Image processing - Components of an Image Processing System. Image Sampling and Quantization: Basic concepts in Sampling and Quantization - Representing the Digital Image –(Some basic relationship between pixels)* - Import and Export of Image using Matlab - Types of Color Space Conversion.

Unit II: Spatial Transformation and Enhancement **-12 Hrs**

Spatial Transformation: Interpolation - Interpolation Methods - Image Resizing - Image Rotation - Image Cropping. Image Enhancement: Noise Removal - Linear Filtering - Adaptive Filtering – (Image Histogram)*. Image Smoothing: Image Averaging and Mean Filters - Ordered Statics Filters. Image Sharpening: High Pass Filter and Homomorphic Filtering.

Unit III: Image Analysis **-12 Hrs**

Segmentation: Region Extraction - Pixel based Approach - Multi-level Thresholding - Local Thresholding. Region based Approach: Region Growing - Region Splitting - Region Merging - Split and Merge. Edge Detection: Derivative Operators – (Pattern Fitting Approach)* - Morphological Edge Detection - Edge Linking and Edge Following - Edge Element Extraction by Threshold - Edge Detector Performance - Corner Detection.

Unit IV: Feature Extraction and Recognition **-12 Hrs**

Feature Extraction: Representation of Boundary, Medial Axis Transform & Thinning. Topological Attributes: Connectivity Numbers - Components Labelling - Component Counting - Computing Genus. Geometrical Attributes: Perimeter - Diameter of the Enclosing Circle - Area-Slope, Curvature and Straightness - Convexity. Object Recognition: Knowledge Representation – (Statistical Pattern Recognition)* - Neural Nets - Fuzzy Systems.

Unit V: Application of Image Processing **-12Hrs**

Face Recognition - Iris Recognition - Fingerprint Recognition - Medical Image processing - Satellite Images - Remote Sensing – **(Sleepiness Detection - Object Detection) *.**

*** Indicates Self - Study Component**

Total Hours: 60 Hrs

Reference Books:

1. **Rafael C. Gonzalez and Richard E.Woods, (2018), *"Digital Image Processing"*, Prentice Hall,Fourth Edition.**
2. B.Chanda and D.DuttaMajumder, (2011), ***"Digital Image Processing and Analysis"***, Prentice-Hall ofIndia Pvt Ltd, Second Edition.
3. Madhuri A. Joshi, (2017), ***"Digital Image Processing An Algorithmic Approach"***, PHILearning PvtLtd, Second Edition.
4. Image Processing Toolbox, User's Guide, The Math Works Inc, 2019.

Course Outcomes:

CO1: Appreciate the role of image processing and its digital formation.

CO2: Build the knowledge about spatial transformation.

CO3: Explain various processing involved in image analyzing.

CO4: Implement various feature extraction techniques.

CO5: Develop small applications using image processing techniques.

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

Soft Computing

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

23MCSC19 **No. of Credits: 4**

Objectives:

1. To introduce soft computing concepts and techniques.
2. To teach fundamentals of Neural Networks, Fuzzy Logic, Genetic algorithms and Deep learning
3. To experiment the soft computing techniques using MATLAB.

Unit I: Introduction to AI and Neural Networks **-12 Hrs**

Introduction to Artificial Intelligence systems – Neural Networks - Fuzzy Logic - Genetic Algorithm - Fundamentals of Neural Networks – Basic concepts – Model of an Artificial Neuron. Neural Network Architecture – Characteristic of Neural Network – (Learning methods – History of Neural Networks)*. PERCEPTRON. Creating a custom Neural Networks using MATLAB.

Unit II: Back Propagation Networks **-12 Hrs**

Architecture – BPN learning – (BPN algorithm)* – Illustration – Selection of various parameters in BPN - Augmented BPN – Variations of BPN algorithm. Adaptive Resonance Theory – ART 1 Architecture Algorithm Object Recognition using BPN in MATLAB.

Unit III: Fuzzy Logic **-12 Hrs**

Fuzzy Logic – Fuzzy Set Theory versus Crisp Sets – Fuzzy sets – Membership function – Fuzzy Set Operations - Fuzzy Systems – (Crisp Logic – Predicate Logic)*. Fuzzy Logic – Fuzzy Rule Based System – Defuzzification Methods .Simple Fuzzy system using MATLAB.

Unit IV: Genetic Algorithm **-12 Hrs**

Basic Concepts – (Biological Background)* – Creation of Off springs – Encoding – Binary Encoding – Fitness function. Reproduction Roulette – Wheel Selection - Genetic Modeling – Inheritance Operators – Cross Over - Inversion and Deletion – Mutation Operator - Hybrid Systems. Minimizing a function using Genetic Algorithm in MATLAB.

Unit V: Deep Learning **-12 Hrs**

Definition of Deep Learning - (Deep learning Back Ground)* – Three Classes of Deep Learning Neural Networks. Deep Networks for Unsupervised Learning - Deep Networks for Supervised Learning and Hybrid Deep Networks. Object detection using Deep Learning in MATLAB.

*** Indicates Self - Study Component**

Total Hours: 60

Reference Books:

1. David E. Gold Berg, (2000), ***"Genetic Algorithms in Search, Optimization and MachineLearning"***,Addision Wesley.
2. S. Rajasekaran, G.A. VijayalakshmiPai, (2017), ***"Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications"***, Second Edition, Prentice Hall of India Pvt Ltd, New Delhi.
3. Madan M. Gupta, Liang Jin and Noriyasu Homma, (2003), ***"Static and Dynamic Neural Networks"***, John Wiley and Sons, Inc., Huboken, New Jersey.
4. S. N. Sivanandam, S. N. Deepa, (2018), ***"Principles of Soft Computing"***, Third Edition, Wiley, India.
5. Li Deng, Dong Fu, (2013), ***"Deep Learning Methods & Applications"*** , Foundations and Trends_ inSignal Processing, vol. 7, nos. 3–4, pp. 197–387.

E-Learning Resource

1. www.microsoft.com/en-us/research/publication/deeep-learning-methods-and-applicationsin.mathworks.com/

Course Outcomes:

CO1 : Acquire basic knowledge in AI and Neural Networks.

CO2 : Appreciate the types of Back Propagation networks.

CO3 : Implement Fuzzy Logic using MATLAB toolbox.

CO4 : Apply Genetic Algorithm in various real world applications.

CO5 : Implement Deep Learning in various Networks.

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

Elective - Machine Learning (Open book)

Semester III **Hours of instruction / week: 3**

23MCSC20A **No. of credits: 3**

Objectives:

1. To impart knowledge about the concepts and techniques of machine Learning
2. To apply suitable machine learning algorithms for data handling and to gain knowledge from it
3. To evaluate the performance of algorithms and to provide solution for various real world applications.

Unit I: Introduction to Machine Learning and Data Pre-Processing - 9 Hrs

Introduction to Machine Learning, Life Cycle of Machine Learning Model Development, (Types of Machine Learning)*, Applications of Machine Learning.**Data Pre-Processing in ML:** Data Overview, Data Cleaning, Data Integration, Data Transformation, Data Reduction – Dimensionality Reduction, Data Compression, AttributeSubset Selection.

Case Study: Installation of Python (Anaconda Environment) and Importing Libraries

Unit II: Data Sampling and Feature Engineering - 9 Hrs

Data Sampling: Oversampling, Undersampling, Feature Engineering in ML: Feature Selection – Filter Methods, Wrapper Methods, Embedded Methods, Hybrid Methods, Feature Extraction – Regularization, Feature Creation – Feature Splitting, Discretization. (Exploratory Data Analysis)*, Train_Test_Split.

Case Study: Identify a Benchmark Dataset, Understand the Data and apply the suitable pre-processing Techniques and also select the significant features using various feature engineering methods.

Unit III: Supervised and Unsupervised Learning - 9 Hrs

Supervised Learning: Classification Algorithms – Decision Tree, Random Forest, Support Vector Machine, K-Nearest Neighbor, Naïve Bayes, Logistic Regression, Problem of Overfitting and Underfitting. (Binary Classification vs. Multi-Class Classification vs. Multi-label Classification)*. Regression Algorithms: Linear Regression, Non-Linear Regression. Performance Metrics.

Unsupervised Learning: Types of Clustering – Partitioning Method, Hierarchical Method, Density-based Methods, Grid-based Methods. Clustering Algorithms and Association Algorithms.

Case Study: Develop a classification / regression model for Email Spam Detection using supervised learning.

Unit IV: Reinforcement and other Learning Methods **- 9 Hrs**

Reinforcement Learning: Significant Terms in Reinforcement Learning, Process of Reinforcement Learning, Approaches to Implement Reinforcement Learning – Value-based, Policy-based, Model-based, Elements of Reinforcement Learning – Policy, Reward Signal, Value function, Model of the Environment, Working of Reinforcement Learning – Bellman Equation, Markov Decision Process, Reinforcement Learning Algorithms.

Other Learning Methods: Model-based Learning, Instance-based Learning, Shallow Learning, Deep Learning, Transfer Learning, One-Shot Learning, Zero-Shot Learning, N-Shot Learning, Sequence-to-Sequence Learning, Active Learning, (Ensemble Learning)*.

Case Study: Develop a Q – Learning Model for problems in automotive domains / gaming.

Unit V: Neural Networks and Deep Learning **- 9 Hrs**

Introduction to Neural Networks, Multilayer Perceptron, Backpropagation, Convolutional Neural Network, Feed-Forward Neural Network, Recurrent Neural Network, Pooling, Input Layer, Hidden Layer and Output layer in Deep Learning, Activation Functions, Optimization, Long Short Term Memory, Generative Adversarial Networks, Radial Basis Functions, Deep Belief Networks, Restricted Boltzmann Machine (RBM), Autoencoder, (AI vs. ML vs. DL)*.

Case Study: Develop a Deep learning Model for pattern recognition / image recognition.

*** Indicates Self – Study Component**

Total Hours: 45

Reference Books:

1. Anuradha Srinivasaraghavan and Vincy Joseph (2019), *Machine Learning*, Wiley.
2. AndriyBurkov (2019), *The Hundred-Page Machine Learning Book*
3. Manaranjan Pradhan and U Dinesh Kumar (2019), *Machine Learning using Python*, Wiley.
4. Aggarwal, C. C. (2018). *Neural Networks and Deep Learning: A Textbook.* Springer.

Course Outcomes:

CO1: Gain foundational understanding of machine learning concepts.

CO2: Understand the concept of exploratory data analysis and its role in feature engineering.

CO3: Design and implement various supervised and unsupervised machine learning algorithms.

CO4: Compare the reinforcement learning paradigm to other learning paradigms

CO5: Able to develop deep learning models for solving real world applications.

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

Elective - Internet of Things (Open book)

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

23MCSC20B **No. of Credits: 3**

Objectives:

1. To know the fundamentals of Internet of Things
2. To learn about the basic components of IoT
3. To understand various opportunities to work with IoT

Unit I: Introduction to IoT **-9 Hrs**

Introduction – Definition and Characteristics. Physical Design of IoT. Logical Design of IoT – Functional blocks, Communication models and APIs. IoT enabling technologies – WSN, Cloud computing, Big data analytics, Embedded systems. Domain Specific IoTs – Home, City, Environment, Energy, Agriculture and Industry.

Unit II: IoT Design methodology **-9 Hrs**

Introduction – Purpose and requirements specification, Process specification, Domain model specification, Information model specification, Service specification, IoT level specification, Functional view specification, Operational view specification, Device and component integration, Application development.

Unit III: IoT Physical Devices and Endpoints **-9 Hrs**

What is an IoT Device – Building blocks of IoT. Exemplary Device: Raspberry PI. 12 About the Board. Linux on Raspberry PI. Raspberry PI Interfaces – Serial interfaces, SPI, I2C. Programming Raspberry PI with Python – Controlling and interfacing LED switches. Other IoT Devices – pcDuino, BeagleBone Black, Cubieboard

Unit IV: Controlling Hardware"s & Sensors **-9 Hrs**

Connecting LED, Buzzer, Controlling servo motor, speed control of DC Motor, temperature sensor with thermistor, voltage sensor, Temperature and Humidity Sensor DHT11, Motion Detection Sensors, Level Sensors, Distance Measurement with ultrasound sensor, Wifi Module, Wireless Bluetooth Sensors, ZigBee, RFID

Unit V: IoT Cloud, Applications & Case Studies **-9 Hrs**

(Introduction to Cloud Computing – Definition)*, IoT network architecture, and wearable IoT networks. Weather Reporting System, Smart Parking system, Air pollution Monitoring System, Smart Gas leakage system, Smart Anti-Theft System, Case studies: Home Automation – IoT printers.

*** Indicates Self - Study Component**

Total Hours: 45

Text Books:

1. ***ArshdeepBahga, Vijay Madisetti****(2014), Internet of Things: A Hands-On Approach, VPT Publishers.*

Reference Books:

1. ***Adrian McEwen, Hakim Cassimally****, (2013),* ***Designing the Internet of Things,*** *Wiley Publications.*
2. ***CunoPfister****, (2011),* ***Getting Started with the Internet of Things: Connecting Sensors andMicrocontrollers to the Cloud, 1st Edition,*** *MakerMedia, Inc.*

E-learning Resources:

1. onlinecourses.nptel.ac.in
2. www.academy-cube.com/cisco-internet-of-things

Course Outcomes:

CO1: Understand the basic ideas of IoT

CO2: Design and implement an IoT device for a given problem-domain

CO3: Explore and learn about IoT with the help of preparing prototypes using Raspberry Pi

CO4: Understand about Hardware"s components and sensors used for developing IoT Products

CO5: Master the basics of IoT cloud platforms and Real time application

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	M	-	-	M	-	M	-	-	-	M	M	-
CO 2	H	H	M	-	-	M	-	M	-	-	-	M	M	-
CO 3	H	H	H	H	M	H	-	M	M	M	M	M	H	-
CO 4	-	-	H	-	M	M	-	M	-	H	H	-	-	M
CO 5	H	H	H	H	H	H	-	H	M	H	H	H	H	M

Elective - Software Testing (Open book)

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

23MCSC20C **No. of Credits: 3**

Objectives:

1. To learn the overview of software testing concepts and its techniques.
2. To expose to various testing tools.
3. To understand and manage the effective testing process.

Unit I: Introduction **-9 Hrs**

Basics of Software Testing –Evolution - Myths and Facts-Goals - Definitions-Model for Software Testing- Software Testing as a Process- Software Testing Terminology and Methodology Software Testing Life Cycle (STLC)- types of testing- testing in the development life-cycle - testing principles-Verification and Validation – Test case design strategies.

Unit II: Dynamic Testing **-9 Hrs**

Black-Box Testing Techniques - Requirement based testing - Boundary Value Analysis (BVA) - Equivalence Class Testing - State Table-Based Testing - Cause-Effect Graphing Based Testing - Decision Table-Based Testing - Error Guessing. White-Box Testing Techniques: Need - Logic Coverage Criteria - Basis Path Testing - Graph Matrices - Loop Testing - Data Flow Testing - Mutation Testing

Unit III: Levels of Testing **-9 Hrs**

Need for Levels of Testing - unit testing – Test Harness - Integration testing - system testing –Types of system test: Functional, performance, stress and configuration testing - Regression testing - Acceptance testing- Performance testing – (Alpha –Beta Tests)* – Usability and accessibility testing-Regression Testing Techniques

Unit IV: Managing the Testing Process **-9 Hrs**

Test Organization-Structure of Testing Group-Test Planning- Detailed Test Design and Test Specifications-Definition of Software Metrics- Classification -Entities to be Measured-Size Metrics-Testing Metrics for Monitoring and Controlling the Testing Process-Estimating Testing Efforts-Cyclomatic Complexity Measures for Testing- Function Point Metrics for Testing-Test Point Analysis (TPA).

Unit V: Software Quality Assurance **-9 Hrs**

The software quality challenge, Meaning of software quality, Software quality factors, Software Quality Lessons Learned, The components of the software quality assurance system, Pre-project software quality components: Contract Review, Development and quality plans, SQA components in the project life cycle: Integrating quality activities in the project life cycle Management components of software quality: Project progress control, (Software quality metrics)*, Costs of software quality, Standards, certification and assessment.

*** Indicates Self - Study Component**

Total Hours: 45

Reference Books:

1. ***Naresh Chauhan(2013), Software Testing Principles andPractices, 2013,*** *6 thimpression, OxfordUniversity Press.*
2. ***Ilene Burnstein, Practical Software Testing, 2013, 12th Edition,*** *Springer VerlagInternational Edition, Springer, India.*
3. ***Srinvasan Desikan, Software Testing principles and practices,2012,*** *4th Edition,PearsonPublication.*
4. ***Daniel Galin, Software Quality Assurance: From theory to implementation,*** *PearsonEducation Limited, 2004, ISBN 0201 70945 7*

Course Outcomes

CO1: Gain knowledge on software testing process

CO2: Choose appropriate testing techniques and tools for real time testing applications

CO3: Analyze and understand the levels of testing

CO4: Gain Knowledge on software metrics

CO5: Understand software Quality Assurance

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	M	-	-	M	-	M	-	-	-	M	M	-
CO 2	H	H	M	-	-	M	-	M	-	-	-	M	M	-
CO 3	H	H	H	H	M	H	-	M	M	M	M	M	H	-
CO 4	-	-	H	-	M	M	-	M	-	H	H	-	-	M
CO 5	H	H	H	H	H	H	-	H	M	H	H	H	H	M

Computing Lab V- Mobile Application Development

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

23MCSC21 | **No. of Credits: 3**

Objectives:

1. To apply java to android platform to develop mobile apps.
2. To provide an architecture/design overview of the android environment.
3. To practice the programming skills and develop marketable software for smart phones.

List of Programs

1. Design a Mobile App using Textbox, Colors.
2. Design a Mobile App using Image Effects.
3. Design a Mobile App Using Checkbox.
4. Design a Mobile App to perform Mathematical operations.
5. Design a Mobile App using conditional Statements.
6. Design a Mobile App using function.
7. Design a Mobile App using Button.
8. Design a Mobile App using Image Button.
9. Design a Mobile App using Switch.
10. Design a Mobile App String Functions.
11. Design a Mobile App to indent activity.
12. Design a Mobile App to perform Multiple Activity pages.
13. Design a Mobile App for Login Activity.
14. Design a Mobile App to Single-touch and Multi-touch on Screen.
15. Design a Mobile App for Media player.
16. Design a Mobile App using Google Map Activity.
17. Design a Mobile App to perform Text to Speech Activity.
18. Design a Mobile App to Connect with SQLite Database (using Student table).
19. Design a Mobile App to Connect with SQLite Database (using Employee table).
20. Design a Mobile App to Connect with SQLite Database (using Product table).

Total Hours: 60

Course Outcomes:

CO1: Able to use the development tools in the Android environment

CO2: Learn major components of Android API set to develop their own apps

CO3: Apply Java programming language to build Android apps

CO4: Appreciate new UI components

CO5: Develop android apps for distribution on the Google Play Store

CO / PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PS O1	PS O2	PS O3
CO1	M	M	M	L	L	-	-	-	-	-	L	M	L	-
CO2	H	H	H	L	L	H	-	M	M	L	L	H	M	M
CO3	H	H	M	L	L	M	-	M	M	L	L	H	M	M
CO4	M	M	M	L	L	-	-	-	-	-	L	M	L	-
CO5	H	H	H	L	L	H	-	M	M	L	L	H	M	M

Technical Communication (Self-Study Course)

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

23MCSC22 **No. of Credits: 4**

Objectives:

1. To impress onthe 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 **-3 Hrs**

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

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

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 **-3 Hrs**

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

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

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 **-3 Hrs**

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 HillCompany.
2. Krista Van Laan, (2013), ***"The insider's guide to technical writing"***, First Edition, XMLPress.

Course Outcomes:

CO1: Effective presentation and writing skills

CO2: Improve speaking skills

CO3: Apply various style of technical communication

CO4: Draft resume, letters and email with professionalism

CO5: Proficiency in preparing technical articles, review and research articles

CO / PO	PO 1	PO 2	P O 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	-	L	L	-	M	L	L	L	L
CO 2	-	-	-	-	M	-	L	L	-	M	M	L	L	L
CO 3	-	-	-	-	L	L	M	M	M	M	M	M	M	M
CO 4	-	-	-	-	M	-	L	L	-	M	L	L	L	L
CO 5	-	-	-	-	L	L	M	M	M	M	M	M	M	M