

COURSE STRUCTURE

Master in Computer Applications (MCA) [Two Years Programme]

Under
Choice Based Credit System (CBCS)

First Semester

| S. NO | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HRS/WK |
|-------------------|----------|-------------------------------------|-----------------|----------|-----------|----------|-----------|-----------------|
| | | | L | T | P | J | | |
| 1. | MCAC0008 | Data Structures | 3 | 1 | 0 | 0 | 4 | 4 |
| 2. | MCAC0003 | Computer Organization | 3 | 0 | 0 | 0 | 3 | 3 |
| 3. | MCAC0010 | Operating Systems | 3 | 0 | 0 | 0 | 3 | 3 |
| 4. | MCAC0016 | Programming in Python | 3 | 0 | 0 | 0 | 3 | 3 |
| 5. | MCAC0012 | Software Engineering | 3 | 0 | 0 | 0 | 3 | 3 |
| 6. | BELH0003 | English for Professional Purposes-I | 2 | 0 | 0 | 0 | 2 | 4 |
| 7. | BELH0006 | Ethics & Values | 2 | 0 | 0 | 0 | 2 | 2 |
| PRACTICALS | | | | | | | | |
| 8. | MTDH0301 | Soft Skills-I | 0 | 0 | 4 | 0 | 1 | 4 |
| 9. | MCAC0806 | Data Structures Lab | 0 | 0 | 4 | 0 | 2 | 4 |
| 10. | MCAC0810 | Python Programming Lab | 0 | 0 | 4 | 0 | 2 | 4 |
| 11. | MCAC0802 | Computer Organization Lab | 0 | 0 | 2 | 0 | 1 | 2 |
| TOTAL | | | 19 | 1 | 14 | 0 | 26 | 36 |

Second Semester

| S. NO | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HRS/WK |
|-------------------|----------|--------------------------------------|-----------------|---|---|---|---------|-----------------|
| | | | L | T | P | J | | |
| 1. | MCAC0009 | Database Management System | 3 | 0 | 0 | 0 | 3 | 3 |
| 2. | MCAC0011 | Computer Networks | 3 | 1 | 0 | 0 | 4 | 4 |
| 3. | MCAC0007 | Object Oriented Programming | 3 | 0 | 0 | 0 | 3 | 3 |
| 4. | BELH0004 | English for Professional Purposes-II | 2 | 0 | 0 | 0 | 2 | 4 |
| 5. | MCAC0014 | Web Technology | 3 | 0 | 0 | 0 | 3 | 3 |
| 6. | MCAC0013 | Design and Analysis of Algorithm | 3 | 1 | 0 | 0 | 4 | 4 |
| PRACTICALS | | | | | | | | |
| 7. | MTDH0302 | Soft Skills-II | 0 | 0 | 4 | 0 | 1 | 4 |
| 8. | MCAC0805 | Object-Oriented Programming Lab | 0 | 0 | 4 | 0 | 2 | 4 |
| 9. | MCAC0809 | Web Technology Lab | 0 | 0 | 2 | 0 | 2 | 2 |
| 10. | MCAJ0950 | Mini Project-I | 0 | 0 | 0 | 2 | 2 | 0 |
| 11 | MCAC0807 | Database Management System Lab | 0 | 0 | 2 | 0 | 1 | 2 |

| | | | | | | | | |
|--|--|--------------|-----------|----------|-----------|----------|-----------|-----------|
| | | TOTAL | 17 | 2 | 12 | 0 | 27 | 33 |
|--|--|--------------|-----------|----------|-----------|----------|-----------|-----------|

Third Semester

| S. NO | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HRS/WK |
|-------------------|----------|-----------------------|-----------------|---|---|---|---------|-----------------|
| | | | L | T | P | J | | |
| 1. | PE-1 | | | | | | | |
| 2. | PE-2 | | | | | | | |
| 3. | PE-3 | | | | | | | |
| 4. | PE-4 | | | | | | | |
| 5. | PE-5 | | | | | | | |
| 6. | BCHS0201 | Environmental Studies | 2 | 0 | 0 | 0 | 2 | 2 |
| PRACTICALS | | | | | | | | |
| 7. | MCAJ0951 | Mini Project-II | 0 | 0 | 0 | 2 | 2 | 0 |
| | | TOTAL | | | | | | |

Forth Semester

| S. NO | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HRS/WK |
|-------|----------|---------------------|-----------------|---|---|----|---------|-----------------|
| | | | L | T | P | J | | |
| 1. | MCAJ0970 | Industrial Training | 0 | 0 | 0 | 26 | 26 | 0 |

Program Core

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE- REQUISITES |
|-------------------|----------|----------------------------------|-----------------|----------|-----------|----------|-----------|----------------|-----------------------------|
| | | | L | T | P | J | | | |
| THEORY | | | | | | | | | |
| 1. | MCAC0003 | Computer Organization | 3 | 0 | 0 | 0 | 3 | 3 | |
| 2. | MCAC0007 | Object Oriented Programming | 3 | 0 | 0 | 0 | 3 | 3 | Computer Programming |
| 3. | MCAC0008 | Data Structures | 3 | 1 | 0 | 0 | 4 | 4 | |
| 4. | MCAC0009 | Database Management System | 3 | 0 | 0 | 0 | 3 | 3 | |
| 5. | MCAC0010 | Operating Systems | 3 | 0 | 0 | 0 | 3 | 3 | |
| 6. | MCAC0011 | Computer Networks | 3 | 1 | 0 | 0 | 4 | 4 | |
| 7. | MCAC0012 | Software Engineering | 3 | 0 | 0 | 0 | 3 | 3 | |
| 8. | MCAC0013 | Design and Analysis of Algorithm | 3 | 1 | 0 | 0 | 4 | 4 | |
| 9. | MCAC0014 | Web Technology | 3 | 0 | 0 | 0 | 3 | 3 | Object Oriented Programming |
| 10. | MCAC0016 | Programming in Python | 3 | 0 | 0 | 0 | 3 | 3 | |
| PRACTICALS | | | | | | | | | |
| 10. | MCAC0802 | Computer Organization Lab | 0 | 0 | 2 | 0 | 1 | 2 | |
| 11. | MCAC0805 | Object Oriented Programming Lab | 0 | 0 | 4 | 0 | 2 | 4 | |
| 12. | MCAC0806 | Data Structures Lab | 0 | 0 | 4 | 0 | 2 | 4 | |
| 13. | MCAC0807 | Database Management System Lab | 0 | 0 | 2 | 0 | 1 | 2 | |
| 14. | MCAC0809 | Web Technology Lab | 0 | 0 | 4 | 0 | 2 | 4 | |
| 15. | MCAC0810 | Programming in Python Lab | 0 | 0 | 4 | 0 | 2 | 4 | |
| | | Total | 30 | 3 | 20 | 0 | 43 | 53 | |

Program Elective

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE- REQUISITES |
|--|----------|--------------------------------------|-----------------|---|---|---|---------|----------------|-------------------|
| | | | L | T | P | J | | | |
| Bouquet : Computer Network & Security | | | | | | | | | |
| THEORY | | | | | | | | | |
| 1. | MCAE0001 | Principles of Mobile Computing | 3 | 0 | 0 | 0 | 3 | 3 | Computer Networks |
| 2. | MCAE0002 | Ad Hoc Networks | 3 | 0 | 0 | 0 | 3 | 3 | Computer Networks |
| 3. | MCAE0003 | Cryptography & Network Security | 3 | 0 | 0 | 0 | 3 | 3 | |
| 4. | MCAE0004 | Cyber security and Digital Forensics | 3 | 0 | 0 | 0 | 3 | 3 | Computer Networks |

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE- REQUISITES |
|--------------------------------------|----------|-------------------------------|-----------------|---|---|---|---------|----------------|----------------------|
| | | | L | T | P | J | | | |
| Bouquet :Software Engineering | | | | | | | | | |
| THEORY | | | | | | | | | |
| 1. | MCAE0101 | Agile Software Development | 3 | 0 | 0 | 0 | 3 | 3 | Software Engineering |
| 2. | MCAE0102 | Software Project Management | 3 | 0 | 0 | 0 | 3 | 3 | Software Engineering |
| 3. | MCAE0103 | Service Oriented Architecture | 3 | 0 | 0 | 0 | 3 | 3 | Software Engineering |
| 4. | MCAE0104 | Management Information System | 3 | 0 | 0 | 0 | 3 | 3 | Software Engineering |
| 5. | MCAE0105 | E-Commerce | 3 | 0 | 0 | 0 | 3 | 3 | |

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|--|----------|----------------------------------|-----------------|---|---|---|---------|----------------|--------------------------|
| | | | L | T | P | J | | | |
| Bouquet : Image Processing and Intelligent System | | | | | | | | | |
| THEORY | | | | | | | | | |
| 1. | MCAE0201 | Digital Image Processing | 3 | 0 | 0 | 0 | 3 | 3 | Mathematics, Programming |
| 2. | MCAE0202 | Introduction to Machine Learning | 3 | 0 | 0 | 0 | 3 | 3 | Mathematics |
| 3. | MCAE0203 | Soft Computing | 3 | 0 | 0 | 0 | 3 | 3 | Discrete Mathematics |
| 4. | MCAE0204 | Artificial Intelligence | 3 | 0 | 0 | 0 | 3 | 3 | Data Structures |
| PRACTICALS | | | | | | | | | |
| 1. | MCAE0271 | Digital Image Processing Lab | 0 | 0 | 2 | 0 | 1 | 2 | Programming |
| 2. | MCAE0272 | Machine Learning Lab | 0 | 0 | 2 | 0 | 1 | 2 | |

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE- REQUISITES |
|--|----------|------------------------------|-----------------|---|---|---|---------|----------------|--------------------|
| | | | L | T | P | J | | | |
| Bouquet :Advanced Data Processing | | | | | | | | | |
| THEORY | | | | | | | | | |
| 1. | MCAE0301 | Data Mining and Warehousing | 3 | 0 | 0 | 0 | 3 | 3 | DBMS |
| 2. | MCAE0302 | Business Intelligence | 3 | 0 | 0 | 0 | 3 | 3 | DMW |
| 3. | MCAE0303 | Information Retrieval System | 3 | 0 | 0 | 0 | 3 | 3 | Data Structure |
| 4. | MCAE0304 | Big Data and Analytics | 3 | 0 | 0 | 0 | 3 | 3 | DBMS |
| 5. | MCAE0305 | Internet of Things | 3 | 0 | 0 | 0 | 3 | 3 | Microprocessors |
| 6. | MCAE0306 | Cloud Computing | 3 | 0 | 0 | 0 | 3 | 3 | Distributed System |
| PRACTICALS | | | | | | | | | |
| 1. | MCAE0370 | Big Data and Analytics Lab | 0 | 0 | 2 | 0 | 1 | 2 | |
| 2. | MCAE0371 | Internet of Things Lab | 0 | 0 | 2 | 0 | 1 | 2 | |
| 3. | MCAE0372 | Cloud Computing Lab | 0 | 0 | 2 | 0 | 1 | 2 | |

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE- REQUISITES |
|---------------------------------------|----------|---------------------------------------|-----------------|---|---|---|---------|----------------|-----------------|
| | | | L | T | P | J | | | |
| Bouquet : Advance Technologies | | | | | | | | | |
| THEORY | | | | | | | | | |
| 1. | MCAE0402 | .Net Framework using C# | 3 | 0 | 0 | 0 | 3 | 3 | |
| 2. | MCAE0403 | Mobile Application Development | 3 | 0 | 0 | 0 | 3 | 3 | |
| 3. | MCAE0404 | Digital Marketing and Transformation | 3 | 0 | 0 | 0 | 3 | 3 | |
| 4. | MCAE0405 | Object Oriented Programming Using C++ | 3 | 0 | 0 | 0 | 3 | 3 | |
| PRACTICALS | | | | | | | | | |
| 1. | MCAE0471 | .Net Framework Lab | 0 | 0 | 4 | 0 | 2 | 4 | |
| 2. | MCAE0472 | Mobile Application Development Lab | 0 | 0 | 2 | 0 | 1 | 2 | |
| 3. | MCAE0473 | Object Oriented Programming Lab | 0 | 0 | 4 | 0 | 2 | 4 | |

Projects

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE-REQUISITES |
|--------|----------|-----------------|-----------------|----------|----------|-----------|-----------|-------------------|----------------|
| | | | L | T | P | J | | | |
| 1. | MCAJ0950 | Mini Project-I | 0 | 0 | 0 | 2 | 2 | - | |
| 2. | MCAJ0951 | Mini Project-II | 0 | 0 | 0 | 2 | 2 | - | |
| 3. | MCAJ0971 | Major Project | 0 | 0 | 0 | 25 | 25 | - | |
| | | Total | 0 | 0 | 0 | 29 | 29 | - | |

Program Core of Humanities and Social Sciences

| S. NO. | CODE | SUBJECT | TEACHING SCHEME | | | | CREDITS | CONTACTS HR/WK | PRE-REQUISITES |
|-------------------|----------------------|--------------------------------------|-----------------|----------|----------|----------|-----------|-------------------|----------------|
| | | | L | T | P | J | | | |
| THEORY | | | | | | | | | |
| 1. | BELH0003 | English for Professional Purposes-I | 2 | 0 | 0 | 0 | 2 | 4 | |
| 2. | BELH0004 | English for Professional Purposes-II | 2 | 0 | 0 | 0 | 2 | 4 | |
| 3. | MELH0007 BELH0006 | Ethics & Values | 2 | 0 | 0 | 0 | 2 | 2 | |
| 4. | MBAC0004 | Accounting & Financial Management | 2 | 1 | 0 | 0 | 3 | 3 | |
| 5. | BCHS0201 | Environmental Studies | 2 | 0 | 0 | 0 | 2 | 2 | |
| PRACTICALS | | | | | | | | | |
| 6. | MTDH0301 | Soft Skills-I | 0 | 0 | 2 | 0 | 1 | 2 | |
| 7. | MTDH0302 | Soft Skills-II | 0 | 0 | 4 | 0 | 1 | 2 | |
| | | Total | 10 | 1 | 6 | 0 | 13 | 19 | |

Note:

1. Student must obtain at least **104 credits** in two years for completion of MCA degree.

MCAC0003: COMPUTER ORGANIZATION

Objective: This course aims to introducing the concept of computer organization. In particular, it focuses on basic hardware architectural issues that affect the nature and performance of software.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Introduction: Basic organization of the computer and block level description of the functional units, Number representation; fixed and floating-point number representation, IEEE standard for floating point representation., Instruction set, Instruction cycles. Register, bus and memory transfer.</p> <p>Central Processing Unit: Addition and subtraction of signed numbers, carry look ahead adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Processor organization, general registers organization, stack organization and addressing modes. Introduction to Combinational Circuit, Multiplexer, demultiplexer, Decoder, Encoder. Introduction to Sequential Circuit, Flip-Flops, Synchronous and Asynchronous Counters</p> <p>Multiprogramming and Multiprocessing; Introduction to pipelined operation.</p> | 18 |
| II | <p>Control Unit: Instruction types, formats, micro-operations, execution of a complete instruction. Hardwired and micro programmed control: micro programmed sequencing, Microinstruction with next address field, pre-fetching microinstructions, concept of horizontal and vertical microprogramming.</p> <p>Memory: Basic concept and hierarchy, RAM memories, ROM memories. Cache memories: concept and design issues, performance, address mapping and replacement. Virtual memory: concept and implementation.</p> <p>Input/Output: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Buses, bus architecture, types of buses and bus arbitration. Modes of Data Transfer: Programmed I/O, interrupt initiated I/O and Direct Memory Access., I/O channels and processors. Standard communication interfaces.</p> | 18 |

Text Books:

- M. Mano (1996), "Computer System Architecture", 3rd Edition, PHI.

Reference Books:

- D.W. Patterson (2008), "Computer Organization and Design", 4th Edition, Elsevier Publication.
- William Stalling (2011), "Computer Organization", 8th Edition, PHI
- V. Carl Hamacher, Zaky (1996), "Computer Organization", 4th International Edition, TMH.
- John P Hays, "Computer Organization", 2nd Edition, TMH.
- Tannenbaum (2005), "Structured Computer Organization", 5th Edition, PHI.
- P Pal Chaudhry (2002), "Computer Organization & Design", 2nd Edition, PHI.

Outcome: After completion of the course, the student will be able to:

- Understand the organization of the modern computer system hardware.
- Analyze the performance of component, able to calculate the effective address of different operands, arithmetic operations of positive and negative numbers.
- Understand the Basic hardware architectural issues that affect the nature and performance of software.

MCAC0007: OBJECT ORIENTED PROGRAMMING

Objective: This course introduces the concepts of object-oriented programming, UML and RMO architecture.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>OO Fundamentals: Need of OO approach, OO Concepts. Characteristics of Object oriented programming.</p> <p>Basics of Java: Features of Java, Byte Code and Java Virtual , JDK, Data types, Operator, Control Statements.</p> <p>Array and String: Single and Multidimensional Array, String class, Operations on string, Command line argument, Use of Wrapper Class. Classes, Objects and Methods: Class, Object, Constructor, new operator, Constructor Overloading, Method Overloading, Recursion, Passing and Returning object form Method, this and static keyword (variable, method, class and package), Access control, modifiers, Nested class, Inner class, Abstract class, Java Standard Libraries.</p> <p>Polymorphism: Method overloading.</p> <p>Inheritance and Interfaces: Use of Inheritance, Inheriting Data members and Methods, constructor in inheritance, Types of Inheritance, super keyword, Final keyword, Creation and Implementation of an interface, Dynamic method dispatch, Comparison between Abstract Class and interface.</p> | 18 |
| II | <p>Multithreaded Programming: Use of Multithread programming, Thread State Diagram, Thread class methods, Runnable interface, Thread priority.</p> <p>Exception Handling: Exception and Error, Built in Exception, Use of try, catch, throw, throws and finally, Custom exception.</p> <p>GUI Programming: Java Applet, Applet life cycle, Applet Vs Application, Graphics methods, Layout- Flow, Grid, Border, Introduction to AWT Programming, Introduction to Swing, AWT Vs Swing, GUI development in AWT, Swings, Event Delegation Model, Event Handling using Button.</p> <p>JDBC: Database Connectivity Model, Types and Roles of Drivers, Database Connectivity Statements, Communicating with Database.</p> | 18 |

Text Books:

- Herbert Schildt, “Java the Complete Reference”, TMH. 8th edition

Reference Books:

- Kathy Sierra & Bert Bates, “Head First Java”, O’Reilly, 2nd Edition.
- Patrick Naughton, “Java Handbook”, Osborne McGraw-Hill.
- Khalid A Mughal, Rolf W Rasmussen, “A Programmer’s Guide to Java SE 8 Oracle Certified Associate (OCA)”, Addison-Wesley Professional.

Outcome: After the completion of the course, students will be able to:

- Understand differences between procedures oriented and object oriented approach.
- Understand the relevance of Object Oriented Programming techniques.
- Understand how to write, compile and execute a Java Program.
- Understand the use of polymorphism and Inheritance.

MCAC0008: DATA STRUCTURES

Objective: To be familiar with the basic concepts of programming and algorithm designing.

Credits: 04

L-T-P-J: 3-1-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction to Data Structure, Types, Data Structure Operations, Algorithm Complexity and Time-Space trade-off.</p> <p>Array: Representation of Single and Multidimensional Arrays, Address Calculation, Operations on Arrays, and Application of Arrays: Matrix Multiplication, Sparse Polynomial Representation and Addition, Character String Operation.</p> <p>Stacks: Array Representation and Implementation of Stack, Operations on Stacks: Push & Pop.</p> <p>Queues: Array Representation and Implementation of Queues, Operations on Queue- Create, Add, Delete, Full and Empty, Types of Queues: Circular Queue, D-Queue and Priority Queue.</p> <p>Application of Stack: Conversion of Infix to Prefix and Postfix Expressions, Evaluation of Postfix Expression using Stack.</p> <p>Recursion: Recursive Definition and Processes, Recursion in C.</p> <p>Linked Lists: Representation and Implementation of Singly Linked Lists, Operations on Linked Lists - Insertion and Deletion to/from Linked Lists, Linked Stacks and Queues, Overflow and Underflow Conditions, Polynomial Representation and Addition and Multiplication of Polynomials, Doubly Linked List, Circular linked list.</p> | 19 |
| II | <p>Trees: Introduction, Binary Trees and their Representation, Algebraic Expressions, Complete Binary Tree. Extended Binary Trees, Array and Linked Representation of Binary Trees, Traversing Binary Trees, Path Length, Huffman Algorithm.</p> <p>Binary Search Trees: Binary Search Tree (BST), Insertion and Deletion in BST.</p> <p>Types of Tress: Threaded Binary trees, AVL Trees, Introduction to Multi-way Search trees, B-tree.</p> <p>Searching and Hashing: Sequential Search, Binary Search, Comparison and Analysis, Hashing Functions, Hash Tables and Collision Resolution Techniques.</p> <p>Sorting: Bubble Sort, Selection Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort, Radix Sort, Shell Sort.</p> <p>Graphs: Terminologies and Representation, Path Matrix, Graph Traversals - DFS and BFS, Shortest Path Problems, Minimum Cost Spanning Trees, Topological Sort.</p> | 19 |

Text Book:

- Lipschutz (2006) "DataStructuresSchaum's Outline Series", TMH 12th Reprint.

Reference Books:

- Horowitz and Sahani(2004) "Fundamentals of Data Structures", W H Freeman & Co.
- Jean Paul Trembley and Paul G. Sorenson (2007) "An Introduction to Data Structures with applications", Tata McGraw Hill 2nd Edition.
- R. Kruse etal (2004) "Data Structures and Program Design in C", Pearson Education 2nd Edition.

Course Outcomes:

- CO 1: Understand the concepts of linear and non-linear data structures.
- CO 2: Analyze algorithms and determine their time and space complexity.
- CO 3: Implement array and linked list data structure to solve various problems.
- CO 4: Understand and Implementation stack and queue using static and dynamic allocation.
- CO 5: Understand and construct various searching and sorting algorithms.
- CO 6: Understand and implement trees data structure.

MCAC0009: DATABASE MANAGEMENT SYSTEM

Objective: To acquire the knowledge of database design, data models and database languages and to study the physical and logical database designs, database modeling, relational, hierarchical, and network models

Credits: 03

L-T-P-J :3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction: An Overview of Database Management System, Database System Vs File System, Database System Concept and Architecture, Data Model Schema and Instances, Data Independence, Database Language and Interfaces (DDL, DML, DCL), Database Development Life Cycle (DDLC) with Case Studies.</p> <p>Data Modeling Using the Entity-Relationship Model: ER Model Concepts, Notation for ER Diagram, Mapping Constraints, Keys, Specialization, Generalization, Aggregation, Reduction of an ER Diagram to Tables, Extended ER Model.</p> <p>Relational Data Model and Language: Relational Data Model Concepts, Integrity Constraints, Entity Integrity, Referential Integrity, Keys Constraints, Domain Constraints, Relational Algebra</p> <p>Database Design & Normalization I: Functional Dependencies, Primary Key, Foreign Key, Candidate Key, Super Key, Normal Forms, First, Second, Third Normal Forms, BCNF, Non-Redundant Cover, Canonical Cover</p> | 13 |
| II | <p>Database Design & Normalization II: 4th Normal Form, 5th Normal Form, Lossless Join Decompositions, , MVD and JDs, Inclusion Dependence.</p> <p>File Organization: Indexing, Structure of Index files and Types, Dense and Sparse Indexing</p> <p>Transaction Processing Concept: Transaction System, Testing of Serializability, Serializability of Schedules, Conflict & View Serializable Schedule, Recoverability, Recovery from Transaction Failures, Log Based Recovery, Deadlock Handling.</p> <p>Concurrency Control Techniques: Concurrency Control, Locking Techniques for Concurrency Control, 2PL, Time Stamping Protocols for Concurrency Control, Validation Based Protocol.</p> <p>Distributed Database: Introduction of Distributed Database, Data Fragmentation and Replication.</p> | 14 |

Text Book:

- Elmasri and Navathe (2010) "*Fundamentals of Database Systems*", Addison Wesley, 6th Edition.

Reference Books:

- Date C J (1993) "*An Introduction to Database Systems*", Addison Wesley, 8th Edition.
- Korth, Silbertz and Sudarshan (1998) "*Database Concepts*", McGraw Hill, 5th Edition.
- Bipin C. Desai (2008) "*An Introduction to Database Systems*", Gagotia Publications.
- Majumdar and Bhattacharya (2002) "*Database Management System*", TMH.

Course Outcome:

- C01:** Understand the basic concepts and the applications of database systems.
- C02:** Design ER Model and Relational Database Schema for real world application, given unambiguous problem statement.
- C03:** Implement SQL queries to access data, given relational database schema.
- C04:** Implement views, constrains and index, PL/SQL procedures and functions for a given scenario.
- C05:** Develop relational algebra expressions, given the relational database schema.
- C06:** Understand and apply database normalization principles.
- C07:** Describe the concepts of transaction and classification of database.

MCAC0010: OPERATING SYSTEMS

Objective: To provide the understanding of principals and techniques in operating system and processing of program execution.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction: Operating System and Functions, Classification of Operating Systems- Batch, Interactive, Multiprogramming Time Sharing, Real Time System, Multiprocessor Systems, Multiuser Systems, Multithreaded Systems, Operating System Structure- Layered Structure, Reentrant Kernels, Monolithic and Microkernel Systems, System Components, Operating System Services.</p> <p>Processes: Process Concept, Process States, Process Transition Diagram, Process Control Block (PCB), Principle of Concurrency, Producer/Consumer Problem, Inter Process Communication Models and Schemes, Process Generation, Threads and their Management.</p> <p>CPU Scheduling: Scheduling Concepts, Schedulers, Performance Criteria, Scheduling Algorithms, Multiprocessor Scheduling.</p> <p>Process Synchronization: Mutual Exclusion, Critical Section Problem, Dekker's Solution, Peterson's Solution, Semaphores, Test and Set Operation, Classical Problem in Concurrency- Dining Philosopher Problem, Readers Writers Problem, Sleeping Barber Problem.</p> | 19 |
| II | <p>Deadlock: System model, Deadlock Characterization, Prevention, Avoidance and Detection, Recovery from Deadlock, Combined Approach.</p> <p>Memory Management: Basic Bare Machine, Resident Monitor, Multiprogramming with Fixed Partitions, Multiprogramming with Variable Partitions, Paging, Segmentation, Paged Segmentation, Virtual memory Concepts, Demand Paging, Performance of Demand Paging, Page Replacement Algorithms, Thrashing, Cache Memory Organization, Locality of Reference.</p> <p>I/O Management and Disk Scheduling: I/O Devices, I/O Subsystems, I/O Buffering, Disk Storage and Disk Scheduling, RAID.</p> <p>File System: File Concept, File Organization and Access Mechanism, File Directories, and File Sharing, File System Implementation Issues, File System Protection and Security.</p> | 19 |

Text Book:

- Silberschatz, Galvin and Gagne (2005) "Operating Systems Concepts", Wiley, 7th edition.

Reference Books:

- Sibsankar Halder and Alex A Aravind (2009) "Operating Systems", Pearson Education, 6th Edition.
- Harvey M Dietel (2002) "An Introduction to Operating System", Pearson Education, 2nd Edition.
- D M Dhamdhare (2006) "Operating Systems: A Concept based Approach", 2nd Edition.
- M. J. Bach (1986) "Design of the Unix Operating System", Prentice Hall of India.

Course Outcomes:

CO 1: Describe the elements and various functionalities of the operating system to a basic level.

CO 2: Describe and implement methods for process scheduling, process synchronization and Shell layer architecture.

CO 3: Describe various memory allocation strategies and implement virtual memory techniques for effective memory management.

CO 4: Explain I/O Communication techniques and DMA working.

CO 5: Describe and implement methods for process synchronization and deadlocks.

CO 6: Explain the physical and logical structure of the storage media and illustrate various algorithms for storage management.

MCAC0011: COMPUTER NETWORKS

Objective: To be familiar with the fundamental concepts of computer networking and familiarize the student with the basic taxonomy and terminology of the computer networking area

Credits: 04

L-T-P-J: 3-1-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Network Edge - Internet - ISPs and Internet Backbones, Use of Computer Networks, Type of Networks, Reference Models- The OSI Reference Model, TCP/IP Reference Model.</p> <p>Physical Layer: Direction of Data Flow, Types of Connections, Topologies, Transmission Media-Guided and Unguided, Modulation, Multiplexing, Circuit Switching.</p> <p>Data Link Layer : Error Detection and Correction ,Parity – LRC,CRC; Hamming code, Flow Control and Error Control, Stop and Wait, Go Back-N ARQ , Selective Repeat ARQ, Sliding Window, LAN - Ethernet IEEE 802.3 - IEEE 802.4 - IEEE 802.5 - IEEE 802.6.</p> <p>Medium Access Sub Layer: Static/Dynamic Channel Allocation in LAN's and MAN's, Multiple Access Protocols, ALOHA, Carrier Sense, Collision Free Protocols</p> | 19 |
| II | <p>Transport Layer-: Duties of Transport Layer, User Datagram Protocol (UDP), Transmission Control Protocol (TCP) – Segment Format, Window Management; Congestion Control, Quality of Services (QOS) – Integrated Services.</p> <p>Application Layer: Domain Name Space, SMTP, FTP, HTTP, Telnet, WWW, Security, Cryptography-Substitution and Transposition, Ciphers, Data Encryption Standard (DES), DES Chaining, RSA Algorithm -Public Key Cryptography; Authentication Protocols, Firewall, VPN.</p> | 19 |

Text Book:

- A.S. Tanenbaum,(2006) "*Computer Networks*", Second Ed., Prentice Hall, India.

Reference Books:

- Kurose, J.F. and Ross K.W., (2005)"*Computer Networking: A Top-Down Approach Featuring the Internet*", Third Edition, Addison-Wesley.
- Forouzan B A. (2004)"*Data Communication and Networking*", Third Edition, McGrawHill.

Outcome: After the completion of the course, the student will be able to:

- CO1-Understanding the network infrastructure and the concept of OSI and TCP/IP models
- CO2- Analyze MAC layer protocols and LAN technologies
- CO3- Apply the concept of network infrastructure using internet protocols
- CO4- Understanding and analyzing algorithms.
- CO5- Understand the working of transport layer protocols, application layer protocols and analyze congestion control algorithms.
- CO6- Understand IPv6 addressing and differentiate it from IPv4

MCAC0012: SOFTWARE ENGINEERING

Objective: To be familiar with the basic concepts of Programming principle and Concept of various type of software.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introductory Concepts: The evolving role of software – characteristics, components and applications.</p> <p>Process Models: Waterfall Model, Prototyping, Incremental, Spiral.</p> <p>Agile software Development: Introduction to Agile, Agile software development framework.</p> <p>Software Requirement Specification: Requirement Process, SRS Components, Requirement Specifications with Use Cases Diagram.</p> <p>Software Project Planning: Project Planning Objectives.</p> <p>Software Metrics: Size, Function Point, Staffing, Project Estimation Methods–COCOMO Model.</p> <p>Function-Oriented Design: Problem Partitioning, Abstraction, Top Down and Bottom Up Design.</p> <p>Module-Level Concepts: Coupling, Cohesion, Design Notation and Specification - Structure Charts; Structured Design Methodology - Data Flow Diagram, Sequence Diagram.</p> | 18 |
| II | <p>OO Analysis and OO Design: OO Concepts, Introduction to UML Design Patterns: Class Diagram, Activity Diagram, State Chart Diagram.</p> <p>Coding: Coding Process, Verification – Code Inspections, Software Metrics.</p> <p>Testing Fundamentals: Test Case Design, Black Box Testing Strategies, White Box Testing, Unit Testing, Integration Testing, System Testing.</p> <p>Introduction to Automation Testing and Testing Tools: Automated Testing Process, Framework for Automation Testing, Introduction to Automation Testing Tool.</p> <p>Software Quality: Models, ISO 9000 Certification for Software Industry, SEI Capability Maturity Model.</p> <p>Software Maintenance: Models, Cost of Maintenance, Re-engineering, Reverse Engineering.</p> | 19 |

Text Book:

- R. S. Pressman, (2010) *“Software Engineering – A practitioner’s approach”*, 7th Edition, McGraw Hill Int. Ed.

Reference Books:

- K.K. Aggarwal & Yogesh Singh, (2003) *“Software Engineering”*, 3rd Edition New Age International Publisher.
- P. Jalote, (2004) *“An Integrated approach to Software Engineering”*, Narosa 3rd edition.
- James Peter, W Pedrycz, (2004) *“Software Engineering”*, John Wiley & Sons 4th edition.

Outcome: After the completion of the course, the student will be able to:

- Understand application of software Processes and apply software processes for the construction of SRS using requirement engineering.
- Estimate the cost, effort and schedule of software using COCOMO Model.
- Analyze and apply design techniques (structure chart, SDM, sequence diagram) in designing software.
- Analyze software using software metrics and understand coding process.
- Apply different testing techniques and tools necessary for software testing.

- Apply different maintenance models for maintenance of software and understand the concept of software Quality.

MCAC0013: DESIGN & ANALYSIS OF ALGORITHM

Objective: To analyze and design the algorithms, use of various computational models and techniques.

Credits: 04

L-T-P-J: 3-1-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Algorithms: Analyzing algorithms, Complexity of Algorithms. Growth of functions: Asymptotic Notations, Recurrence Relations and their Solution Methods. Sorting and Order Statistics: Counting, Radix, Bucket sort. Advanced Data Structures: Augmenting Data Structures; B – trees, Binomial Heaps, Fibonacci Heaps; Data Structure for Disjoint Sets. Divide and Conquer: Quick Sort, Merge Sort. Greedy Method: Knapsack Problem, Job Sequencing with Deadlines, Activity Selection Problem, Huffman Codes.</p> | 18 |
| II | <p>Dynamic Programming: Chained Matrix Multiplications, Longest Common Subsequence (LCS), 0/1 Knapsack. Backtracking: 8 – Queens Problem, Graph Coloring. Branch & Bound: TSP Problem. Approximation Algorithms: Vertex & Set Cover Problem Graph Algorithms: Minimum Spanning Trees; Depth First Search, Breadth First Search; Maximum Flow. Single Source Shortest Path Problem: Dijkstra & Bellman Ford Algorithms. String Matching: Naïve, Rabin Karp, Knuth-Morris-Pratt, Automata Matcher. NP-Completeness: Basic Concepts, Nondeterministic Algorithms, NP-Completeness, Examples of NP Complete Problems.</p> | 19 |

Text Book:

- G. Brassard and P. Bratley, (2001) "Algorithmics, PHI T.H. Coremen", et. al, "Introduction to Algorithm", PHI.

Reference Books:

- A. Aho, J. Hopcroft and J. Ullman, (1983) "The design and Analysis of Computer Algorithms", Addison Wesley.
- E. Horowitz and S. Sahani, (2001) "Fundamentals of Computer Algorithms", Galgotia, New Delhi.
- S.E. Goodman and S.T. Hedetniemi, (1977) "Introduction to the Design and Analysis of Algorithms", McGraw Hill.

Outcome:

- After completion of this course, the student will get knowledge complexity of algorithm, behavior analysis of algorithm.
- He will be able to apply important algorithmic design paradigms and methods of analysis.

MCAC0014: WEB TECHNOLOGY

Objective: To understand various steps in designing a creative and dynamic website.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours) |
|------------|--|------------------|
| I | <p>Introduction to Client Server Architecture: Components of Client/Server Application, Client Server Models and their Benefits. Server Side Component Architecture, Multitier Architecture, Web Portal Development & Testing.</p> <p>Implementation: HTML- List, Table, Frame, Image, Form and Other Tags with their Usage, Formatting using CSS, DHTML; JavaScript, DOM Basics, Statements, Integrating JavaScript with Various Elements of HTML, XHTML.</p> <p>XML: Domain Languages, Comparison with HTML, DTD, CSS, XSL, Content Creation — Entities, Attributes, XML Schema, XML Parsing Techniques;</p> | 19 |
| II | <p>XML and Data Binding-JAXB, Integrating XML with other Applications, XLINK , XPOINTER. Introduction to AJAX and Applications.</p> <p>Distributed Object Computing: ActiveX, COM, & DCOM.</p> <p>Web Servers & Application Servers: Web Security, Middleware Standards-CORBA, Enterprise Java Beans and DNA, Web Services and SOA.</p> <p>Server Side Implementation: CGI Background, Overview of PERL, Introduction to ASP, Objects, Components, Connecting with Databases. JSP Architecture, Objects, JSP Directive Elements, Variables & Methods, Sharing Session & Application Data, Introduction to PHP –Basics, Array and Functions.</p> | 19 |

Text Book:

- Chris Bates (2007) "*Web Programming – Building Internet Application*", 2nd Edition, Wiley-Dreamtech India Pvt. Ltd.

Reference Books:

- Holzener, Steven (2001) "*Inside XM*", Techmedia publication.
- Bergstan, Hans (2004) "*Java Server Pages*", O'Reilly Publication.
- Nicholas C. Zakas (2011) "*Professional JavaScript for Web Developers*", Wiley Publication.
- Leon Shklar, Rich Rosen (2009) "*Web Application Architecture: Principles, Protocols and Practices*", 2nd Edition Wiley Publication.
- Burdman, Jessica (2000) "*Collaborative Web Development*", Addison Wesley.

Outcome:

- Web based applications development and deployment on web server. Operational knowledge of middleware technologies and security issues related to web.
- The student will be able to learn html, xml and to know about various application servers such as CORBA.

MCAC0016: PROGRAMMING IN PYTHON

Objective: This course introduces the solving of mathematical problems using Python programming using OO concepts and its connectivity with database.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Lab Hours |
|------------|---|-----------|
| I | <p>Introduction to Python: Introduction and Basics; Setting up path Python Data Variables & Operators: Data Variables and its types, id() and type() functions, Coding Standards;</p> <p>Control Structures: if-else, elif, Nested if, Iteration Control structures, Break, Continue & Pass;</p> <p>String Manipulation: Accessing Strings, Basic Operations, String slices Function and Methods.</p> <p>Lists: Introduction, accessing list, Operations, Working with lists, Function and Methods.</p> <p>Tuple: Introduction, accessing tuples, Operations, Working, Functions and Methods.</p> <p>Dictionaries: Introduction, accessing values in dictionaries, Working with dictionaries, Properties, Functions.</p> <p>Functions: Defining & Calling a function, Passing arguments to functions – Mutable & Immutable Data Types, Different types of arguments, Recursion, Scope of variables;</p> | 18 |
| II | <p>Modules and Packages: User-defined modules and Standard Library: random, numpy, sys, Math Module, String Module, List Module, Date & Time Module, Regular Expressions: match, search, replace;</p> <p>Introduction to PIP, Installing Packages via PIP</p> <p>Input-Output: Printing on screen, reading data from keyboard, Opening and closing file, Reading and writing files, Functions.</p> <p>Exception Handling: Exception, Exception Handling, Except clause, Try? finally clause, User Defined Exceptions.</p> <p>Introduction to series and dataframes & Python using Pandas.</p> <p>Object Oriented Programming: Creating Classes, Instance Variables & Access Specifiers, Methods & Complete Python Program, Importance of self, __init__ () method, Instance Methods,</p> | 18 |

Text Books:

- Paul Barry: "Head First Python "O'Reilly Media, Inc.", 2010.

Reference Books:

- Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.

Outcome: By the end of the class, students will learn to:

- Understand to solve problems with smaller Lines of Code using Python as compared to other programming languages.
- use OO concepts while programming in Python.
- use in-built packages defined in Python.
- work with Python using GUI.

MCAC0802: COMPUTER ORGANIZATION LAB

Objective: To analyze performance issues in processor and to understand the memory design.

Credits: 01

L-T-P-J: 0-0-2-0

Course Outcomes:

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <ul style="list-style-type: none"> • Introduction of Computer Organization. • To study and implement various AND GATE using universal gates NAND. • To study and implement various AND GATE using universal gates NOR. • To study and implement various NOT GATE using universal gates NOR. • To study the operation of Demultiplexer. • To study the operation of decimal to BCD encoder. • To study the operation of BCD decoder to decimal. • To study the half adder and full adder using NAND and NOR gates. • To study the half subtractor & full subtractor using NAND & XOR gates. • To study the operation of segment decoder. • To study the operation of Flip –Flop (JK, D, T). • To study the BCD counter. • To study the Ring counter and Johnson counter. | 24 |

Outcome: After completion of this course, students will have an idea about the functionality and behavior of the major subsystems of computer.

MCAC0805: OBJECT ORIENTED PROGRAMMING LAB

Objective: This lab aims to implement various object oriented programming concepts related to the java language.

Credits: 02

L-T-P-J: 0-0-4-0

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <ul style="list-style-type: none"> • Programs based on the concepts of: Java Classes, Constructors, Polymorphism and Keyword Static. • Programs based on the concepts of: Inheritance Using Java, Multithreading Using Thread Class & Interface Runnable, String Handling, Generic Classes and Collection API. • Programs based on the concepts of: <ul style="list-style-type: none"> ○ Applet Programming, Combining Multithreading with Graphics, ○ UI Development Using AWT and Swings, Handling Events on UI Components. • Handling Database Connectivity with Java. • Concepts of Image Processing Using Java. • Implementation of Distributed Computing using RMI. | 24 |

Reference Books:

- Naughton, Schildt, "The Complete Reference JAVA2", 7th Edition, TMH.
- Loy & Wood, "Java Swing", O'Reilly.
- Bhav&Patekar, "Programming with Java", Pearson Education.

Outcome: After completion of course, student will be able to:

- Explain the concepts and data types in JAVA.
- Be able to program using JAVA features.

MCAC0806: DATA STRUCTURES LAB

Objective: To implement the various data structures and to demonstrate the various algorithms of data structure.

Credits: 02

L-T-P-J: 0-0-4-0

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <ul style="list-style-type: none"> • Write a program to insert the element at given position in an array and display that array. • Write a program to delete the element from given position in an array and display that array. • Write a program to demonstrate various operations (length, copy, append, compare) on strings. • Write a program to demonstrate various operations (reverse, extracting a substring from left, extracting a substring from right, extracting a substring from middle) on strings. • Write a program to demonstrate various operations (create, push, pop , overflow, underflow, peek , display) of STACK using array implementation. • Write a program to demonstrate various operations (create, enqueue, dequeue, overflow, underflow, peek, display) of QUEUE using array implementation. • Write a program to demonstrate various operations (create, enqueue, dequeue, overflow, underflow, peek, display) of CIRCULAR QUEUE using array implementation. • Write a program to solve the problem of Tower of Hanoi by using recursion. • Write a program to demonstrate various operations (create, Traversing, searching, inserting an element at beginning, at end, after a given element, deleting an element from beginning, from end, after a given element) of a linked list. • Write a program to demonstrate various operations (create, Traversing, searching, inserting an element at beginning, at end, after a given element, deleting an element from beginning, from end, after a given element) of a doubly linked list. • Write a program to demonstrate various operations (create, push, pop , overflow, underflow, peek , display) of STACK using linked list. • Write a program to demonstrate various operations (create, enqueue, dequeue, overflow, underflow, peek, display) of QUEUE using linked list. • Write a program for addition of polynomials. • Write a program to demonstrate various operations (create, insert a new node, search, find smallest element, find largest element, height, number of elements, number of internal nodes, number of external nodes, delete a node) on binary search tree. • Write a program for Preorder Traversal, In-order Traversal and Post-order traversal of a BST. • Write a program for Linear search. • Write a program for Binary search. • Write a program for Bubble sort. • Write a program for Merge sort. • Write a program for Insertion sort. • Write a program for Selection sort. • Write a program for Quick sort. • Write a program to illustrate traversal of a graph using Breadth- first search. • Write a program to illustrate traversal of a graph using Depth- first search. • Write a program for Minimum Spanning Tree. • Write a program to find shortest path for given source and destination. • Write a program to find shortest path among all pair of vertices. | 48 |

Outcome: At the end of the course,

- students will get the knowledge of various and appropriate data structure to store the data and solving the computational problems.

MCAC0807: DATABASE MANAGEMENT SYSTEM LAB

Objective: *To implement the concept of entity relationship approach and database languages.*

Credits: 01

L-T-P-J :0-0-2-0

| Module No. | Content | Lab Hours |
|------------|---|-----------|
| I | <ul style="list-style-type: none"> • Introduction of Data Definition Language (DDL) and Its commands.(Create, Alter, Drop, Rename). • Introduction of Data Manipulation Language (DML) and Its Commands (Insert, Update, Delete). • Introduction of Transaction Control Language (T.C.L) &Data Control Language(D.C.L.) • Creation, altering and dropping of tables and inserting rows into a table (use constraints while creating tables) examples using SELECT command. • Queries using Aggregate functions (COUNT, SUM, AVG, MAX and MIN), GROUP BY, HAVING and Creation and dropping of Views. • Queries using Conversion functions (to_char, to_number and to_date), string functions (Concatenation, lpad, rpad, ltrim, rtrim, lower, upper, initcap, length, substr and instr), date functions (Sysdate, next_day, add_months, last_day, months_between, least, greatest, trunc, round, to_char, to_date) • To implement concept of Joins in SQL. • To implement the concept of sub-queries. • Introduction to PL/SQL. <ul style="list-style-type: none"> (i) Programs related to Conditional Statements in PL/SQL (ii) Programs related to Cursors. (iii) Programs related to stored Procedures and Functions (iv) Programs related to Triggers. | 32 |

Outcome:

- *After completion of the course students will have a solid foundation in the design and implementation of database applications on a variety of today's most commonly used platforms (e.g. MS SQL, Oracle, and DB2).*

MCAC0809: WEB TECHNOLOGY LAB

Objective: To implement the basic concepts of Object oriented programming and knowledge of Java programming, XML, ASP etc. to develop an interactive web page.

Credits: 02

L-T-P-J: 0-0-4-0

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <p style="text-align: center;">HTML</p> <ul style="list-style-type: none"> • Design a profile page consisting of your CV using following HTML elements: Font, Color-Background & Foreground, Margins, Lists, Links, Graphics: Image Scaling, Alignments, Text Wrapping B/W images, Table: Bordering, Image, cell color, cell alignment. • Apply various types of CSS to above experiment. • Design a web form for user registration with some constraints using javascript. • Program based on javascript functions. <p style="text-align: center;">XML</p> <ul style="list-style-type: none"> • Programs for Internal & External DTD containing student information and displaying it using CSS. • Design XML DTD containing student information using features of Entity and attribute. • Design a program to perform searching based on XML file data. • Design a XML parsing program to read Element value from any XML file using JavaScript. • Design a XML parsing program for data binding and fetching the data in HTML form. • Design a java program to read data from XML file. <p style="text-align: center;">ASP, JSP & PHP</p> <ul style="list-style-type: none"> • Design a web application in ASP using Request & Response for handling HTML form components. • Design ASP application demonstrating the use of Application object and to display the number of times the page has been visited. • Design ASP application demonstrating database connectivity. • Design a website in JSP/PHP for online purchasing. | 48 |

Outcome: At the end of the course, students will be able to:

- Develop web-based application.
- Write clear and effective Server side & Client side script ..
- Access data using PHP & JSP

MCAC0810: PROGRAMMING IN PYTHON LAB

Credits: 02

L-T-P-J: 0-0-4-0

| Module No. | Content | Lab Hours |
|------------|---|-----------|
| I | <p>Programs based on the concepts of:</p> <ul style="list-style-type: none"> • Building Python Modules • Obtaining user Data • Printing desired output <p>Programs based on the concepts of:</p> <ul style="list-style-type: none"> • Conditional if statements • Nested if statements • Using else if and elif <p>Programs based on the concepts of Iteration using different kinds of loops</p> <p>Usage of Data Structures</p> <ul style="list-style-type: none"> • Strings • Lists • Tuples • Sets • Dictionary <p>Programs related to Object Oriented Concepts:</p> <p>Creating Classes, Instance Variables, Access Specifiers, User defined Methods, Importance of self, __init__() method, Class Methods and Static Methods, Using default parameters in Methods.</p> <p>Handling Database Connectivity with Python:</p> <ul style="list-style-type: none"> • Inserting and Retrieving Data • Use of Stored Procedures • Invoking stored functions | 24 |

Text Books:

- Paul Barry: "Head First Python "O'Reilly Media, Inc.", 2010.

Reference Books:

- Bret Slatkin: "Effective Python: 59 Specific ways to write better Python", Addison Wesley, 2015.

Outcome: By the end of the course, students will learn to:

- solve problems with smaller Lines of Code using Python
- use OO concepts while programming in Python
- use in-built packages defined in Python
- use front-end as Python Programming to connect with any back-end

MCAJ0950: MINI PROJECT I

Objective: *To implement a computer language to build a software system to reduce the paper work.*

Credits: 01

L-T-P-J :0-0-0-2

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <p>Students are required to develop a real time application project comprising of minimum 3000 LOC on any platform in a modular structure.</p> <p>The project must be based on any of the subject studied till previous semesters and should have an interactive GUI.</p> <p>The development of the project must consist of the following:</p> <p>Project Planning – Schedule and Activity Estimation using MS Project 2000</p> <p>SRS in IEEE 830-1998 format</p> <p>Process Framework for development</p> <p>Software Design Document as per IEEE-1016</p> <p>Interfaces Detail and Component Level Design</p> <p>Test Cases development as per the stated Software requirement, which is further to be tested on any CASE tool.</p> <p>In order to obtain creativity, it is required that, the software must have minimal use of library/ library functions of respective language/ package</p> | |

Outcome: *After completing the project, the students should gain an insight into the development process of real projects and to understand the concepts of software products and software processes.*

MCAJ0951: MINI PROJECT II

Objective: *To implement a computer language to build a software system to reduce the paper work.*

Credits: 01

L-T-P-J:0-0-0-2

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <p>Students are required to develop a real time application project comprising of minimum 3000 LOC on any platform in a modular structure. The project must be based on any of the subject studied till previous semesters and should have a interactive GUI. The development of the project must consist of the following :</p> <p>Project Planning – Schedule and Activity Estimation using MS Project 2000 SRS in IEEE 830-1998 format Process Framework for development Software Design Document as per IEEE-1016 Interfaces Detail and Component Level Design Test Cases development as per the stated Software requirement, which is further to be tested on any CASE tool. In order to obtain creativity, it is required that, the software must have minimal use of library/ library functions of respective language/ package</p> | |

Outcome:

After completing the project, the students should gain an insight into the development process of real projects and to understand the concepts of software products and software processes.

MCAE0001: PRINCIPLES OF MOBILE COMPUTING

Objective: To study the specifications and functionalities of various protocols/standards of mobile communication system networks. To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | Introduction: Issues in Mobile Computing, Overview of Wireless Telephony, Cellular Concept, GSM, Air-Interface, Channel Structure, Location Management: HLR-VLR, Hierarchical, Handoffs, Channel Allocation in Cellular Systems, CDMA, GPRS. Wireless Networking, Wireless LAN Overview: MAC Issues, IEEE 802.11, Blue Tooth, Wireless Multiple Access Protocols, TCP Over Wireless, Wireless Applications, Data Broadcasting, Mobile IP.WAP- Architecture, Protocol Stack, Application Environment, Applications. | 12 |
| II | Data Management: Data Management Issues, Data Replication for Mobile Computers, Adaptive Clustering for Mobile Wireless Networks, File System, Disconnected Operations, Mobile Agents Computing, Security and Fault Tolerance, Transaction Processing in Mobile Computing Environment. | 14 |
| III | AdhocNetworks: Localization, MAC Issues, Routing Protocols, Global State Routing (GSR), Destination Sequenced Distance Vector Routing (DSDV), Dynamic Source Routing (DSR), Ad Hoc on Demand Distance Vector Routing (AODV), Temporary Ordered Routing Algorithm (TORA),QoS in Ad Hoc Networks, Applications. | 14 |

Text Books:

- Charles Perkins (2001), “Ad hoc Networks”, Addison Wesley.
- Raj Kamal (2007) “Mobile Computing”, Oxford University Press.

Reference Books:

- J. Schiller (2003) “Mobile Communications”, Addison Wesley.
- Charles Perkins (1997) “Mobile IP”, Addison Wesley.
- Upadhyaya (2002) “Mobile Computing”, Springer.

Outcome:

- Students will demonstrate the ability to design a system, component or process as per needs and specification
- An awareness of professional and ethical issues, in particular to those relating security and privacy of user data and user behavior

MCAE0002: AD HOC NETWORKS

Credits:03

L-T-P-J:3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction to Ad Hoc Wireless Networks: Characteristics of MANETS, Applications of MANETS, Challenges.</p> <p>Routing In MANETS: Topology based versus position-based approaches, Topology based routing protocols, and position-based routing, other routing protocols.</p> <p>Data Transmission In MANETS: The broadcast storm, Multicasting, Geocasting.</p> <p>TCP Over Ad Hoc Networks: TCP protocol overview, TCP and MANETS, Solutions for TCP over Ad Hoc network</p> | 14 |
| II | <p>Basics of Wireless Sensors and Applications: The Mica Mote, Sensing and Communication Range, Design Issues, Energy Consumption, Clustering of Sensors, Applications.</p> <p>Data Retrieval in Sensor Networks: Classification of WSNs, MAC Layer, Routing</p> | 13 |
| III | <p>Introduction: Basic principles and challenges, past and ongoing VANET activities. Cooperative Vehicular Safety Applications Enabling technologies, cooperative system architecture, safety applications. Vehicular Mobility Modeling Random models. MAC Layer of Vehicular Communication Networks Proposed MAC approaches and standards, IEEE 802.11p.</p> <p>VANET Routing protocols: Opportunistic packet forwarding, topology-based routing, geographic routing. Standards and Regulations Protocol Stack, DSRC</p> | 13 |

Text Books:

- Ad Hoc and Sensor Networks: Theory and Applications, Carlos de MoraisCordeiro and Dharma PrakashAgrawal, World Scientific Publications / Cambridge University Press,2006.
- Wireless Sensor Networks: An Information Processing Approach, Feng Zhao, Leonidas Guibas, Elsevier Science Imprint, Morgan Kauffman Publishers, 2005

Reference Books:

- Ad Hoc Wireless Networks: Architectures and Protocols, C. Siva Ram Murthy and B. S. Manoj, Pearson Education, 2004.
- Guide to Wireless Sensor Networks, SudipMisra, Isaac Woungang, and Subhas Chandra Misra, Springer International Edition, 2012.
- Wireless Mesh Networking, Thomas Krag and SebastinBuettrich, O'Reilly Publishers,2007.
- Wireless Sensor Networks – Principles and Practice, Fei Hu, Xiaojun Cao, An Auerbach book, CRC Press, 2010.
- Wireless Ad hoc Mobile Wireless Networks-Principles, Protocols and Applications, Subir Kumar Sarkar, et al., Auerbach Publications, Taylor & Francis Group, 2008.
- Wireless Ad hoc Networking, Shih-Lin Wu, Yu-Chee Tseng, Auerbach Publications, 2007
- Wireless Ad hoc and Sensor Networks–Protocols, Performance and Control, Jagannathan Sarangapani, CRC Press, 2007.

Outcome: After completion of course, the student will be able to:

- Understand the concept of mobile ad hoc networks, design and implementation issues and available solutions.
- Demonstrate the routing mechanisms and three classes of approaches: proactive, on-demand, and hybrid.
- Explain sensor networks and their characteristics. This includes design of MAC layer protocols, understanding of power management, query processing, and sensor databases

MCAE0003: CRYPTOGRAPHY & NETWORK SECURITY

Objective: To learn different security mechanisms to secure transmission of data on network .

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction to Cryptography: Introduction to Security Attacks, Services And Mechanisms, Introduction to Cryptology, Conventional Encryption Model, Classical Encryption Techniques-Substitution Ciphers & Transposition Ciphers, Cryptanalysis, Stereography, Stream & Block Ciphers.</p> <p>Modern Block Ciphers: Block Ciphers Principles, DES Principal, Strength of DES, Differential & Linear Cryptanalysis of DES, Block Cipher Model of Operation, Triple DES, AES, BLOWFISH,IDEA Encryption & Decryption, Confidentiality Using Conventional Encryption, Traffic Confidentiality, Key Distribution, Random Number Generation.</p> | 15 |
| II | <p>Principles of Public Key Cryptography: Principle of Public Key Cryptography, Prime and Relative Prime Numbers, Modular Arithmetic, RSA Algorithm, Security of RSA Key Management.</p> <p>Message Authentication & Hash Function: Authentication Recruitments, Authentications Functions, Message Authentication Codes, Digital Signatures, Authentication Protocols Digital Signatures Standard (DSS), Proof of Digital Signatures Algorithm.</p> | 15 |
| III | <p>Electronics Mail Security: Pretty Good Privacy (PGP), S/MIME, IP Security-IP Security Overview, Architecture, Authentication Header; Encapsulating Security Payloads Combining Security Association, Key Management.</p> <p>Web Security: Socket Layer & Transport Layer Security, Secure Electronic Transaction (SET).</p> <p>System Security: Intruders, Viruses and Related Threads, Firewall Design Principles.</p> | 12 |

Text Book:

- William Stalling “*Cryptography and networks security: Principles and Practice*”, Prentice Hall, New jersey.

Reference Books:

- Johannes A Buchmann, “*Introduction to cryptography*,”Spiringer-verlag.
- Bruce Schiener, “*Applied Cryptography*”.
- AtulKahate, “*Cryptography and Network Security*”, TMH.

Outcome:

- After completion of this course students will have an idea about advance concept of information security.
- The student will able to understand the concepts of risk, threats, vulnerabilities and attack and
- To learn security protocols at different layers of Network layer heirachy.

MCAE0004: CYBER SECURITY AND DIGITAL FORENSICS

Credits:04

L-T-P-J:3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Introduction: Introduction and Overview of Cyber Crime - Nature and Scope of Cyber Crime - Types of Cyber Crime: Social Engineering - Categories of Cyber Crime - Property Cyber Crime.</p> <p>Cyber Security issues: Unauthorized Access to Computers - Computer Intrusions - White collar Crimes - Viruses and Malicious Code - Security Engineering - Network Security, Information Security, Web Security, Database Security, Malware Security, Biometric Security, Security in Cloud Computing and Mobile Computing. Software Piracy - Intellectual Property - Digital laws and legislation - Law Enforcement Roles and Responses.</p> | 17 |
| II | <p>Investigation Introduction to Cyber Crime Investigation - Investigation Tools Discovery - Digital Evidence Collection - Evidence Preservation - E-Mail Investigation Tracking - IP Tracking - E-Mail Recovery - Hands on Case Studies - Encryption and Decryption Methods - Search and Seizure of Computers - Recovering Deleted Evidences - Password Cracking.</p> | 17 |
| III | <p>Digital forensics Introduction to Digital Forensics - Forensic Software and Hardware - Analysis and Advanced Tools - Forensic Technology and Practices - Forensic Ballistics and Photography - Face, Iris and Fingerprint Recognition - Audio Video Analysis - Windows System Forensics - Linux System Forensics - Network Forensics.</p> <p>Laws and acts Laws and Ethics - Digital Evidence Controls - Evidence Handling Procedures - Basics of Indian Evidence ACT IPC and CrPC - Electronic Communication Privacy ACT - Legal Policies.</p> | 18 |

Text Books:

- Guide to Computer Forensics and Investigations 6th Edition by Bill Nelson, Amelia Phillips and Christopher Steuart, Cengage Publication
- Incident Response & Computer Forensics, Second edition by Chris Prosise and Kevin Mandia, McGraw-Hill Education

Reference Books:

- Computer Forensics and Digital Investigation with EnCase Forensic v7 1st Edition by Suzanne Widup, McGraw-Hill Education
- Forensic Computer Crime Investigation by Thomas A. Johnson, CRC Press
- Software Forensics : Collecting Evidence from the Scene of a Digital Crime 1st Edition by Robert Slade, McGraw-Hill Education

Outcome: After completion of course, the student will be able to:

- To have various ideas about cybercrime.
- To have knowledge of the various issues of cybercrime.
- To investigate and find the cybercrime.
- To identify the cybercrime.
- To have clear idea of the various laws and acts.

MCAE0101: AGILE SOFTWARE DEVELOPMENT

Objective: Awareness of basics of software engineering concepts and waterfall methodology and exposure to any object oriented programming language such as Java, C# in agile framework

Credits: 03

L-T-P-J :3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Fundamentals of Agile: The Genesis of Agile, Introduction and background, Agile Manifesto and Principles, Overview of Scrum, Extreme Programming, Feature Driven development, Lean Software Development, Agile project management, Design and development practices in Agile projects, Test Driven Development, Continuous Integration, Refactoring, Pair Programming, Simple Design, User Stories, Agile Testing, Agile Tools</p> <p>Agile Scrum Framework: Introduction to Scrum, Project phases, Agile Estimation, Planning game, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint planning and retrospective, Daily scrum, Scrum roles – Product Owner, Scrum Master, Scrum Team, Scrum case study, Tools for Agile project management</p> | 14 |
| II | <p>Agile Software Design and Development: Agile design practices, Role of design Principles including Single Responsibility Principle, Open Closed Principle, Liskov Substitution Principle, Interface Segregation Principles, Dependency Inversion Principle in Agile Design, Need and significance of Refactoring, Refactoring Techniques, Continuous Integration, Automated build tools, Version control. Current researches in Agile software development</p> | 12 |
| III | <p>Agile Testing: The Agile lifecycle and its impact on testing, Test-Driven Development (TDD), xUnit framework and tools for TDD, Testing user stories - acceptance tests and scenarios, Planning and managing testing cycle, Exploratory testing, Risk based testing, Regression tests, Test Automation, Tools to support the Agile tester</p> <p>Industry Trends: Market scenario and adoption of Agile, Agile ALM, Roles in an Agile project, Agile applicability, Agile in Distributed teams, Business benefits, Challenges in Agile, Risks and Mitigation, Agile projects on Cloud, Balancing Agility with Discipline, Agile rapid development technologies</p> | 14 |

References:

- Ken Schwaber & Mike Beedle, Agile Software Development with Scrum, Pearson, 2008
- Robert C. Martin, Agile Software Development, Principles, Patterns and Practices, Prentice Hall, 2002
- Lisa Crispin & Janet Gregory, Agile Testing: A Practical Guide for Testers and Agile Teams, Addison Wesley, 2008
- Alistair Cockburn, Agile Software Development: The Cooperative Game, Addison Wesley, 2006
- Mike Cohn, User Stories Applied: For Agile Software, Addison Wesley 2004

Outcome:

- Understand the background and driving forces for taking an Agile approach to software development
- Understand the business value of adopting Agile approaches
- Understand the Agile development practices
- Drive development with unit tests using Test Driven Development
- Apply design principles and refactoring to achieve Agility

MCAE0102: SOFTWARE PROJECT MANAGEMENT

Objective: To learn the concepts used to develop a software project and to manage the project.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | Introduction And Software Project Planning: Project Management (PM) Fundamentals, People, Process, Product, Technology, Need Identification, Vision And Scope of Document, Project Management Cycle, SPM Objectives, Management Spectrum, SPM Framework, Software Project Planning Objectives, Project Plan, Types of Project Plan, Project Elements, Work Breakdown Structure (WBS), Types of WBS, Functions, Activities and Tasks, Team Dynamics, Project Life Cycle and Product Life Cycle, Ways to Organize Personnel, Project Schedule, Scheduling Objectives, Software Project Estimation Models and Methods, Network Diagrams- PERT, CPM; Bar Charts, Milestone Charts, Gantt Charts. | 15 |
| II | Project Monitoring and Control: Dimensions of Project Monitoring & Control, Earned Value Analysis, Earned Value Indicators- Budgeted Cost for Work Scheduled (BCWS), Cost Variance (CV), Schedule Variance (SV), Cost Performance Index (CPI), Schedule Performance Index (SPI), Interpretation of Earned Value Indicators, Error Tracking. Software Reviews: Types of Review-Inspections, Deskchecks, Walkthroughs, Code Reviews, Pair Programming. Risk Management: Risks and Risk Types, Risk Breakdown Structure (RBS), Risk Management Process: Risk Identification, Risk Analysis, Risk Planning, Risk Monitoring, Cost Benefit Analysis. Software Project Management Tools: CASE Tools. | 12 |
| III | Software Configuration Management: Software Configuration Items and Tasks, Baselines, Plan for Change, Change Control, Change Requests Management, Version Control Testing Objectives, Testing Principles, Test Plans, Test Cases, Types of Testing, Levels of Testing, Test Strategies, Program Correctness, Program Verification & Validation, Testing Automation & Testing Tools, Concept of Software Quality, Software Quality Attributes, Software Quality Metrics and Indicators, Quality Management and ISO 9000 Quality Assurance Method, The SEI Capability Maturity Model (CMM), SQA Activities, Formal SQA Approaches- Proof of Correctness. | 13 |

Text Book:

- M. Cotterell, "Software Project Management", Tata McGraw-Hill Publication.

Reference Books:

- Royce, "Software Project Management", Pearson Education.
- Kieron Conway, "Software Project Management", Dreamtech Press.
- S. A. Kelkar, "Software Project Management", PHI Publication.
- Pankaj Jalote, (2005) Software Project Management in practice, Pearson Education.

Outcome:

- After completion of this course students will have sufficient idea Software Project Management Techniques. He will be able to understand the role of design patterns in software development and
- To understand and be able to explain Software Metrics and Software Reliability.

MCAE0103: SERVICE ORIENTED ARCHITECTURE

Objective: *The use of fundamental understanding of operating system, distributed system and web technologies in service oriented technologies.*

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | Introduction: Roots of SOA, Characteristics of SOA, Comparing SOA to Client Server and Distributed Internet Architectures, Anatomy of SOA, How Components in an SOA Interrelate, Principles of Service Orientation, Web Services, Service Descriptions, Messaging with SOAP, Message Exchange Patterns Coordination, Atomic Transactions, Business Activities, Orchestration, Choreography, Service Layer Abstraction, Application Service Layer, Business Service Layer, Orchestration Service Layer. | 15 |
| II | Service Oriented Analysis: Business Centric SOA, Deriving Business Services, Service Modeling, Service Oriented Design, WSDL Basics, SOAP Basics – SOA Composition, Guidelines – Entity, Centric Business Service Design, Application Service Design, Task Centric Business Service Design, SOA Platform Basics, SOA Support in J2EE, Java API for XML Based Web Services, (JAX,WS), Java Architecture for XML Binding (JAXB), Java API for XML Registries (JAXR) , Java API for XML Based RPC (JAX,RPC). | 14 |
| III | Web Services Interoperability Technologies (WSIT): SOA Support in .NET, Common Language Runtime, ASP.NET Web Forms, ASP.NET Web Services, Web Services Enhancements (WSE), WS, BPEL Basics, WS Coordination Overview, WS Choreography, WS Policy, WS Security. | 11 |

Text Book:

- Thomas Erl (2005), "SOA Principles of Service Design", The Prentice Hall Service Oriented Computing Series from Thomas Erl.

Reference Books:

- Newcomer, Lomow (2005) "Understanding SOA with Web Services", Pearson Education.
- Sandeep Chatterjee, James Webber (2005) "Developing Enterprise Web Services, An Architect's Guide", Pearson Education.
- Dan Woods and Thomas Mattern(2006)"Enterprise SOA Designing IT for Business Innovation"O'REILLY, First Edition.

Outcome:

- To solve and develop program logic for Web Service systems.
- Understanding of how SOA systems differ from traditional non-distributed systems.
- Understand how distributed systems are evolving and how that may change the way business is conducted in the future.
- Understand the impact of SOA on software quality, efficiency, security, performance and flexibility.

MCAE0104: MANAGEMENT INFORMATION SYSTEM

Objective: Explores current Information Systems concepts and technologies. Students learn how information systems give a business or organizations a competitive edge by providing technologies that help managers plan, control, and make decisions.

L-T-P-J: 3-0-0-0

Credits: 03

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>System Concept: Definition of Systems, Components of System, Types of System, Concept of Data and Information.</p> <p>Information Systems: Definition of Information System, Classification of Information System, Operation Support System, Management Support System, Importance of Management Information System.</p> <p>Management Support System and Classifications: Management Information System, Decision Support Systems, Executive Information System, Knowledge Management Systems and Expert System.</p> | 13 |
| II | <p>Role of Management Information System: Competitive Strategy concept, Value Chain and Strategic IS, Business Process Reengineering, Difference between Business Improvement and BPR Concept of Organizational Planning, The Planning Process.</p> <p>Developing MIS System: System Development Life Cycle, Traditional Approach and Prototyping Approach, Feasibility Analysis, System Analysis, System Design.</p> | 13 |
| III | <p>Developing MIS System: System Implementation, Testing, Documentation, Training, Conversion & Maintenance.</p> <p>Applications: Enterprise Resource Planning, Supply Chain Management, Procurement Management Customer Relationship Management. Security & Ethical Challenges of IT. Ethical Responsibilities –Business Ethics, Technology Ethics.</p> | 14 |

Text Books:

- O'Brien (2007) "Management Information System. 8th Edition"; Tata McGraw-Hill Publication.

Reference Books:

- Laudon & Laudon (2007) "Business Information System". 9th Edition. Tata McGraw-Hill Publication.
- Jawedkar, S. (2007) "Management Information System". 3rd Edition. Tata McGraw-Hill Publication.
- David, W. (2008) "Business Data Analysis using Excel". Oxford Publications.

Outcome: Upon successful completion of the course, a student will be able to:

- Understand the critical concepts and terminologies in information systems.
- Understand the role of IT managers in information systems planning, systems development, and hardware and software selection.
- Define problems and the current environment for existing business systems in the areas of accounting, finance, marketing, and manufacturing.
- Know the important business functions provided by typical business software such as Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP).

MCAE0105: E-COMMERCE

Objective: The objectives of the course are to introduce the concept of electronic commerce, and to understand how electronic commerce is affecting business enterprises, governments, consumers and people in general.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | Introduction: Electronic Commerce - Technology and Prospects, Definition of E- Commerce, Economic Potential of Electronic Commerce, Incentives for Engaging in Electronic Commerce, Forces Behind E-Commerce, Advantages and Disadvantages, Architectural Framework, Impact of E-commerce on Business. Network Infrastructure for E- Commerce: Internet and Intranet based E-Commerce, Issues, Problems and Prospects, Network Infrastructure, Network Access Equipments, Broadband Telecommunication (ATM, ISDN, FRAME RELAY). | 15 |
| II | Mobile Commerce: Introduction, Wireless Application Protocol, WAP Technology, Mobile Information Device, Mobile Computing Applications. Web Security: Security Issues on Web, Importance of Firewall, Components of Firewall, Transaction Security, Emerging Client Server, Security Threats, Network Security, Factors to Consider in Firewall Design, Limitation of Firewalls. | 12 |
| III | Encryption: Encryption Techniques, Symmetric Encryption- Keys and Data Encryption Standard, Triple Encryption; Asymmetric Encryption- Secret Key Encryption, Public and Private Pair Key Encryption; Digital Signatures, Virtual Private Network. Electronic Payments: The SET protocol, Payment Gateway, Certificate, Digital Tokens, Smart Card, Credit Card, Magnetic Strip Card, E-Checks, Credit/Debit Card Based EPS, Online Banking, EDI Application in Business, E- Commerce Law, Forms of Agreement, Govt. Policies and Agenda. | 13 |

Text Book:

- Ravi Kalakota,(2004)Andrew Winston, "Frontiers of Electronic Commerce", Addison Wesley.

Reference Books:

- Bajaj and Nag,(2005) "E-Commerce the Cutting Edge of Business", TMH.
- P. Loshin, John Vacca, "Electronic Commerce", Firewall Media, New Delhi.

Outcome:

- Explain the components and roles of the Electronic Commerce environment.
- Explain how businesses sell products and services on the Web.
- Describe the qualities of an effective Web business presence.
- Describe E-Commerce payment systems.
- Explain how to meet the needs of Web site visitors.
- Identify and reach customers on the Web.
- Understand Web marketing approaches and elements of branding.
- Explain the client/server infrastructure that supports electronic commerce.

MCAE0201: DIGITAL IMAGE PROCESSING

Objective: To understand the techniques like image enhancement, transform, restoration, and compression.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction and Fundamentals: Motivation and Perspective, Applications, Components of Image Processing System, Element of Visual Perception, A Simple Image Model, Sampling and Quantization, Some Basic Relationships between Pixels, An Introduction to the Color Image Model.</p> <p>Intensity Transformations and Spatial Filtering: Introduction, Some Basic Intensity Transformation Functions, Histogram Processing, Histogram Equalization, Histogram Specification, Local Enhancement, Enhancement using Arithmetic/Logic Operations – Image Subtraction, Image Averaging, Basics of Spatial Filtering, Smoothing - Mean filter, Ordered Statistic Filter, Sharpening – The Laplacian.</p> | 13 |
| II | <p>Filtering in the Frequency Domain: Fourier Transform and the Frequency Domain, Basis of Filtering in Frequency Domain, Image Smoothing Using Frequency Domain Filters, Image Sharpening Using Frequency Domain Filters, Selective Filtering.</p> <p>Morphological Image Processing: Introduction, Logic Operations involving Binary Images, Dilation and Erosion, Opening and Closing, The Hit-or-Miss Transformation, Morphological Algorithms – Boundary Extraction, Region Filling, Extraction of Connected Components, Convex Hull, Thinning, Thickening.</p> | 14 |
| III | <p>Image Segmentation: Introduction, Point, Detection of Isolated Points, Line Detection, Edge Models, Basic Edge Detection, Canny Edge Detection, Edge Linking and Boundary Detection (Hough Transform), Thresholding, Region-Based Segmentation.</p> <p>Representation and Description: Representation- Boundary (Border) Following, Chain Codes, Polygonal Approximations Using Minimum-Perimeter Polygons, Signatures, Boundary Descriptors, Regional Descriptors.</p> | 13 |

Text Book:

- R.C.Gonzalez and R.E.Woods (2008), “*Digital Image Processing*”, 3rd Edition, Prentice Hall.

Reference Books:

- Anil K. Jain (1989). “*Fundamentals of Digital Image Processing*”, Prentice-Hall.
- Bhabatosh Chanda, D. Dutta Majumder (2011). “*Digital Image Processing and Analysis*”, PHI.

Outcome:

- Sound understanding of digital image processing concepts viz-a-viz image acquisition, perception, transformations, enhancement, analysis etc. and
- he will be able to understand image analysis algorithms

MCAE0203: SOFT COMPUTING

Objective: To introduce students to soft computing concepts and techniques and foster their abilities in designing and implementing soft computing based solutions for real-world and engineering problems.

Credits: 03

L-T-P-J : 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I. | Neural Networks :Introduction to Soft Computing & Neural Computing, Fundamentals of Artificial Neural Network(ANN), Models of ANN, Architectures of ANN(Feed forward and Feedback or Recurrent N/W), Learning Methods in ANN, Taxonomy of ANN System, Single Layer Perceptron, Linearly Separable Task and XOR Problem, Introduction to Error Back Propagation Network(EBPN), Back Propagation Learning, Error Back Propagation Learning Algorithm, Associative Memory, Auto Associative Memory, Bidirectional Hetro-Associative Memory, Adaptive Resonance Theory, Applications of Neural Network, ADALINE, MADALINE Network, Rosenblatt's Perception. | 13 |
| II. | Fuzzy Logic: Introduction to Fuzzy Sets & Crisp Sets, Fuzzy Membership and Fuzzy Operations, Properties of Fuzzy sets, Crisp Relations and Fuzzy Relations, Fuzzy System, Crisp Logic, Propositional Logic and its Laws, Inference in Propositional Logic (Modus Ponens, Modus Tollens and Chain Rule), Fuzzy Logic, Inference in Fuzzy Logic(GMP and GMT), Fuzzy Rule Based System, Fuzzyfication & Defuzzification, Applications of Fuzzy Logic. | 14 |
| III. | Genetic Algorithm(GA): Introduction to GA, Search Optimization Method, Evolutionary Algorithm Working Principle, Biological Background of GA, Working Principles of GA, Flow Chart of Genetic Programming, Encoding(Binary, Value, Permutation, Tree), Operators of GA(Random Population, Reproduction or Selection), Crossover and Mutation, Basics of Genetic Algorithm with Example for Maximize $f(x)=x^2$. | 13 |

Text Book:

- S. Rajsekaran & G.A. VijayalakshmiPai, (2003) "Neural Networks, Fuzzy Logic and Genetic Algorithm: Synthesis and Applications" 4th Edition, Prentice Hall of India.

Reference Books:

- Timothy J Ross (2009), "Fuzzy Logic with Engineering Applications", 3rd Edition, John Wiley and Sons.
- David E. Goldberg (2009), "Genetic Algorithm in Search Optimization and Machine Learning", Addison-Wesley.
- Karray (2009), "Soft Computing and Intelligent Systems Design: Theory, Tools and Applications", 1st Edition Pearson Education.

Outcome: By the end of the course, a student is expected to:

- Learn about soft computing techniques and their applications
- Analyze various neural network architectures
- Define the fuzzy systems.

MCAE0204: ARTIFICIAL INTELLIGENCE

Objective: *The main purpose of this course is to provide the most fundamental knowledge to the students so that they can understand what the AI is. Due to limited time, we will try to eliminate theoretic proofs and formal notations as far as possible, so that the students can get the full picture of AI easily. Students who become interested in AI may go on to the graduate school for further study.*

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Introduction: Introduction to AI, AI Techniques, Level of Model, Criteria for Success, Turing Test.</p> <p>Problems, Problem Spaces & Search: Defining Problem as a Space, Search, Production System, Problem Characteristics, Production System Characteristics, Issues in the Design of Search Programs.</p> <p>Heuristics Search Strategies: Generate and Test, Hill Climbing, Best First Search (A*), Problem Reduction (AO*), Constraint Satisfaction, Means Ends Analysis.</p> | 12 |
| II | <p>Knowledge Representation Issues: Representations and Mappings, Approaches to knowledge Representation, The Frame Problem, Semantic Network, Frame Representation.</p> <p>Using Predicate Logic: Representing Simple Facts in Logic, Representing Instance and is-a Relationship, Computable Functions and Predicates, Resolution, Natural Deduction.</p> <p>Representing Knowledge Using Rules: Procedural Vs Declarative knowledge, Logic Programming, Forward and Backward Searching, Matching knowledge Representation.</p> <p>Game Playing and Search: Introduction, Min-Max algorithm, Alpha-Beta Cut Off, Example of Games.</p> | 14 |
| III | <p>Intelligent Systems: Learning Model, Types of Learning, Components of an Expert System, Categories of Expert System, Stages of Development of Expert System, Expert System Development Tools, Overview of Fuzzy Systems, ANN, Swarm Intelligent Systems.</p> | 14 |

Text Book:

- *E.rich and Knight (2008) "Artificial Intelligence", McGraw Hill International.*

Reference Books:

- *N.J Nilson (1998) "Principles of artificial Intelligence", Narosa Publishing House.*
- *Peterson (2006) "Artificial Intelligence", PHI Ltd.*
- *R.Forsyth (1989) "Expert systems, Principles and Case Studies", Chapman and Hill.*
- *R.Keller (2010) "Expert system Technology Development and Application", Yourdon Press.*

Outcome:

- *After completion of this course, students will have an idea about soft computing skills and modern intelligent system.*

MCAE0301: DATA MINING & WAREHOUSING

Objective: The use of Algorithm, Probability, Statistics and Data structure in information retrieval and storing techniques.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction: Overview, Motivation (For Data Mining), Data Mining-Definition & Functionalities, Data Processing, Form of Data Preprocessing, Data Cleaning: Missing Values, Noisy Data, (Binning, Clustering, Regression, Computer And Human Inspection), Inconsistent Data, Data Integration and Transformation.</p> <p>Data Reduction: Data Cube Aggregation, Dimensionality Reduction, Data Compression, Numerosity Reduction, Clustering, Discretization and Concept Hierarchy Generation.</p> <p>Data Warehousing: Overview, Definition, Delivery Process, Difference Between Database System and Data Warehouse, Multi-Dimensional Data Model, Data Cubes, Stars, Snow Flakes, Fact Constellations, Concept Hierarchy, Process Architecture, 3 Tier Architecture, Data Marting, Aggregation, Historical Information, Query Facility, OLAP Function and Tools. OLAP Servers, ROLAP, MOLAP, HOLAP, Data Mining Interface, Security, Backup and Recovery, Tuning Data Warehouse, Testing Data Warehouse.</p> | 13 |
| II | <p>Concept Description: Definition, Data Generalization, Analytical Characterization, Analysis of Attribute Relevance, Mining Class Comparisons, Statistical Measures in Large Databases, Measuring Central Tendency, Measuring Dispersion of Data, Graph Displays of Basic Statistical Class Description, Mining Association Rules in Large Databases, Association Rule Mining, Mining Single-Dimensional Boolean Association Rules From Transactional Databases- Apriori Algorithm, Mining Multilevel Association Rules From Transactional Databases and Mining Multi-Dimensional Association Rules From Relational Databases.</p> <p>Classification And Predictions: What is Classification & Prediction, Issues Regarding Classification and Prediction, Decision Tree, Bayesian Classification, Classification By Back Propagation, Multilayer Feed-Forward Neural Network, Back Propagation Algorithm, Classification Methods Knearest Neighbor Classifiers, Genetic Algorithm.</p> | 14 |
| III | <p>Knowledge Discovery, Data Mining Cluster Analysis: Data Types in Cluster Analysis, Categories of Clustering Methods, Partitioning Methods. Hierarchical Clustering- CURE And Chameleon, Density Based Methods-DBSCAN, OPTICS, Grid Based Methods- STING, CLIQUE, Model Based Method –Statistical Approach, Neural Network Approach, Outlier Analysis, Multimedia Data-Mining, Multimedia-Databases, Mining Multimedia Data, Data-Mining And The World Wide Web, Web Data-Mining, Mining And Meta-Data, Data Visualization & Overall Perspective, Data Visualization, Applications of Data-Mining.</p> | 13 |

Text Book:

- Jiawei Han, Micheline Kamber, (2006) "Data Mining Concepts & Techniques" Elsevier, Second Edition .

Reference Books:

- M.H. Dunham, (2003) "Data Mining: Introductory and Advanced Topics" Pearson Education, First Edition.
- Sam Anahory, Dennis Murray, (2009) "Data Warehousing in the Real World : A Practical Guide for Building Decision Support Systems, 1/e " Pearson Education, Fourth Edition.

Outcome:

- Understanding to apply data mining concept, algorithm and approaches for real life application.

MCAE0302: BUSINESS INTELLIGENCE

Objective: To learn different data models, concepts related to data warehousing and to use them in business intelligence.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | Introduction to Business Intelligence: Introduction to Digital Data and Its Types – Structured, Semi-Structured and Unstructured, Introduction to OLTP and OLAP (MOLAP, ROLAP, HOLAP), BI Definitions & Concepts, BI Framework, Data Warehousing Concepts and Its Role in BI; BI Infrastructure Components – BI Process, BI Technology, BI Roles & Responsibilities, Business Applications of BI, BI Best Practices. | 13 |
| II | Basics of Data Integration (Extraction Transformation Loading): Concepts of Data Integration, Needs and Advantages of using Data Integration, Introduction to Common Data Integration Approaches; Meta Data - Types and Sources, Introduction to Data Quality, Data Profiling Concepts and Applications, Introduction to ETL using Kettle. | 13 |
| III | Introduction to Multi-Dimensional Data Modeling: Introduction to Data and Dimension Modeling, Multidimensional Data Model, ER Modeling vs. Multi-Dimensional Modeling, Concepts of Dimensions, Facts, Cubes, Attribute Hierarchies, Star and Snowflake Schema, Introduction to Business Metrics and KPIS, Creating Cubes using Microsoft Excel. Basics of Enterprise Reporting: A Typical Enterprise, Malcolm Bridge - Quality Performance Framework, Balanced Scorecard, Enterprise Dashboard, Balanced Scorecard vs. Enterprise Dashboard, Enterprise Reporting using MS Access / MS Excel, Best Practices in the Design of Enterprise Dashboards. | 14 |

Text Book:

- RN Prasad and Seema Acharya (2011), “Fundamentals of Business Analytics”, Wiley India.

Reference Books:

- David Loshin (2012), “Business Intelligence”, 2nd Edition, Elsevier Science & Technology.
- Mike Biere (2010), “Business Intelligence for the Enterprise”, Pearson.
- IBM (2004), “An Introduction to Building Data Warehouse”, Prentice Hall of India.
- Larissa Terpeluk Moss & Shaku Atre (2003), “Business Intelligence Roadmap”, Pearson.

Outcome:

At the end of this course, student will be able to

- Differentiate between Transaction Processing and Analytical applications and describe the need for business intelligence.

MCAE0303: INFORMATION RETRIEVAL SYSTEMS

Objective: This course aims to give students an understanding of the fundamental techniques for hypermedia architectures, design and usability, document management and retrieval, metadata management, and searching the web.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | Introduction to Information Retrieval: IR basic concepts, Information & Data Retrieval, Applications of IR, Web Search Basics, Web Characteristics & Web Graph, Introduction to Web Structure, Content, Usage Based Retrieval, Search Engines Working Approach, Web Crawling & Indexing- Crawling Architecture, Crawling Features, Link Analysis, Web Graph, Hubs and Authorities, Page Rank Computation. Basic IR Models: Basic Modeling concepts, Boolean model, Vector Model, Evaluation of IR- Scoring , TF-IDF, Term Weighting, Recall & Precision. | 13 |
| II | Retrieving User Behavior from the Web: Uncovering Patterns in Web, Content & Structure Pattern Mining, Web Usage Mining Architecture-Preprocessing Tasks, Data Cleaning, Transaction Identification, Discovery Techniques on Web Transactions -Path Analysis, Association Rules, Sequential Patterns, Web Usage Mining Components, Integrating Content and Usage Profiles for Personalization, Practical Web Mining Issues and Applications. Parallel & Distributed IR: Parallel & Distributed IR Architecture, Collection partitioning & Clustering- Flat Clustering and Hierarchical Clustering, Multimedia IR Models & languages. | 14 |
| III | Text & Query Languages: Query Types, Keyword based querying, Structural queries, Metadata, Text & markup languages, Text operations & Document Preprocessing, Indexing & searching, Inverted files, Suffix Trees & Suffix Arrays. Term Vocabulary- Determining the Vocabulary of Terms, Search Structures for Dictionaries, Wild Card Queries, Designing Parsing and Scoring Functions. XML Retrieval: Basic XML Concepts, Extracting Data from Text, Text Centric & Data Centric Retrieval. Vector space model for XML retrieval, Evaluation of XML retrieval, Web Parsing Techniques- DOM, SAX, Transformation Engines and Filters, Data Binding. | 13 |

Text Book:

- Ricardo Baeza-Yates and Berthier Ribeiro (2011) *“Modern Information Retrieval”* Addison Wesley.

Reference Books:

- C. Manning, P. Raghavan, and H. Schütze(2008) *“Introduction to Information Retrieval”*, Cambridge University Press.
- Soumen Chakrabarti (2003) *“Mining the Web: discovering knowledge from hypertext data, Part 2”*, Morgan Kaufmann.
- Gordon Linoff and Michael Berry (2001) *“Mining the Web: Transforming Customer Data into Customer Value”*, John Wiley & Sons.
- Jiawei Han, Micheline Kamber(2000) *“Data mining: concepts and techniques”* Morgan Kaufmann Publishers.
- Anthony Scime (2005) *“Web mining: applications and techniques”*, Idea Group.
- Bing Liu (2007) *“Web data mining: exploring hyperlinks, contents, and usage data”*, Springer.

Outcome: After completion of this course the student will be able to:

- use different information retrieval techniques in various application areas
- apply IR principles to locate relevant information large collections of data
- analyse performance of retrieval systems when dealing with unmanaged data sources
- implement retrieval systems for web search tasks.

MCAE0304: BIG DATA AND ANALYTICS

Prerequisite: Exposure to any object oriented programming language (such as Java) and basic operational knowledge of any RDBMS (such as MySQL)

Credits: 03

L-T-P: 3-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Big Data technology Landscape: Types of Digital Data (Structured, Semi-Structured, Unstructured), Concept, importance and characteristics of data, Challenges with big data, Big data stack, Big Data 1.0, 2.0 and 3.0, Traditional BI vs. Big Data Environment, NoSQL Databases, NoSQL Vs. RDBMS, New SQL, Introduction to Data Science/Scientist</p> <p>HADOOP 1.0: Introducing Hadoop 1.0, Limitations of RDBMS, Hadoop Components, High Level Architecture of Hadoop, History of Hadoop, Special Features of Hadoop, Introduction to HDFS 1.0, Architecture, Daemons, Working with HDFS Command, Introduction to Map-Reduce 1.0, Architecture, Daemons</p> <p>HADOOP 2.0: Introducing Hadoop 2.0, Limitations of 1.0, Introduction to HDFS 2.0, Architecture, Daemons, Introduction to Map-Reduce 2.0, YARN, Architecture, Daemons, Word Count Example using Java, Introduction to Hadoop 3.0, Difference among Hadoop1.0, Hadoop2.0, Hadoop3.0</p> | 13 |
| II | <p>Introduction to Mongo DB: RDBMS vs. MongoDB, JSON, Unique Key, Dynamic Queries, Sharding, Replication, MongoDB QL: Create, Drop Database and Collections, CRUD: Create, Insert, Find, Update, Delete, Map Reduce Programming, Aggregations</p> <p>Introduction to Cassandra DB: Features of Cassandra, CQL Data Types, CQLSH: CRUD, Counter, TTL, List, Set, Map, Tracing, Import Export csv files</p> <p>Introduction to Neo4j: Why graph DB, RDBMS vs. Graph DB, Advantages, Features, Graph Data Model, Neo4j Building Blocks, Neo4j CQL: CQL Clause, CQL Functions, Creating Relationships</p> | 14 |
| III | <p>HADOOP Ecosystem and Flume: Introduction to Hadoop Ecosystem, Sqoop, Zookeeper, Plug-in Components: Impala, Hue, Flume: Introduction, Application, Advantage, Features, Streaming/ Log Data, Architecture, Data Flow, Creating a Twitter Application.</p> <p>Introduction to HIVE: Hive Architecture, Hive Data types, Hive Collection Types, Hive File Formats, Hive Query Language, Hive Partitions, Bucketing, Views, RCFile Implementation, Hive User Defined Function, SerDe, UDF</p> <p>Introduction to Pig: History and Anatomy of Pig, Pig on Hadoop, Use Case for Pig, Pig Primitive Data Types, Pig Latin Overview, Execution Modes of Pig, Field, Tuple, Bag, User Defined Function, Parameters in Pig, Piggy Bank, Word count example using Pig, Pig vs Hive, When to use Pig.</p> | 13 |

Text Book:

- Seema Acharya and SubhashiniChellappan, "Big Data and Analytics", 1st Edition, 2015, Wiley, India.
- Jure Leskovec, AnandRajaraman, Jeff Ullman, "Mining of Massive Datasets", 2nd Edition, 2014, Cambridge University Press.

Reference Books:

- Chuck Lam, "Hadoop in Action", 2nd Edition, 2014, Manning Publications.

Outcome: At the end of the course, student will be able to

- CO 1. Understand the concept and challenges of big data
- CO 2. Work with existing technology to collect, manage, store, query, and analyze the various form of big data;
- CO 3. Perform job scheduling of various applications and resource management in the cluster using Hadoop and Yarn
- CO 4. Do the data summarization, query, and analysis over the big data with the help of pig and hive
- CO 5. Prepare the regression model, cluster and decision tree over the real big data

MCAE0305: INTERNET OF THINGS

Objective: To Implement Data and Knowledge Management and use of Devices in IoT Technology.

Credits: 03

L-T-P: 3-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction to IoT: Introduction to IoT- Sensing, Actuation, Logical design of IoT, Functional blocks of IoT, Communication models, IoT & M2M: Machine to Machine, Difference between IoT and M2M,</p> <p>Introduction to Sensors: About Sensor, Properties of Sensors, Basic physical principles of sensing, Categorization of Sensor, PIR Sensor, Temperature Sensor, Ultrasonic Sensor, IR Sensor, MQ2/MQ3</p> | 14 |
| II | <p>Implementing IoT Introduction to different IoT Tools, Introduction to Arduino Programming. Integration of Sensors and Actuators with Arduino. Implementation of IoT with Arduino, Node MCU and Raspberry Pi. Mini project Statement using Node MCU.</p> | 13 |
| III | <p>IoT Over Network IOT Networking Protocols: TCP/IP, 6LowPan, RPL, Thread. Communication Protocol: CoAP, SMTP, HTTP, HTTPS, MQTT, MQTT-S SDN for IoT, Implementing web server. Tools for data handling using web services. Data Handling and Analytics in Cloud and Fog Computing.</p> | 14 |

Reference Books:

- Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)
- ArshdeepBahga and Vijay Madiseti "Internet of Things: A Hands-on Approach", by (Universities Press)

Outcome: After completion of Lab, student will be able to:

- CO1: Understand the concepts of Internet of Things.
- CO2: Analyze basic protocols in IOT.
- CO3: Design IoT applications in different domain and be able to analyze their performance.
- CO4: Able to implement basic IoT applications on embedded platform.

MCAE0306: CLOUD COMPUTING

Objective: To understand cloud computing, its key security and control considerations identify various cloud services, cloud characteristics and service attributes and to evaluate various cloud delivery models.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Overview of Cloud Computing - Brief history and Evolution of Cloud Computing, Traditional vs. Cloud Computing, Importance of Cloud Computing, Cloud service models (IaaS, PaaS & SaaS). Cloud deployment models (Public, Private, Hybrid and Community Cloud), Benefits and Challenges of Cloud Computing.</p> <p>Working with Private Cloud – Concept of Hypervisor, Basics of virtualization, Virtualization technologies, Server virtualization, VM migration techniques, Role of virtualization in Cloud Computing. Business cases for the need of Cloud computing environment, Concept of Private Cloud, Characteristics of Private Cloud, Private Cloud deployment models, Private Cloud Vendors, Private Cloud Building blocks (Physical Layer, Virtualization Layer, Cloud Management Layer), Virtual Private Cloud. Case study on (one out of CloudStack, OpenStack, Eucalyptus, IBM or Microsoft).</p> | 13 |
| II | <p>Working with Public Clouds – Concept of Public Cloud, Importance of Public Cloud, When to opt for Public Cloud, Public Cloud Service Models, and Public Cloud players. Infrastructure as a Service Offerings, IaaS Vendors, PaaS offerings, PaaS vendors, Software as a Service. Implementing public cloud (one out of AWS, Windows Azure, IBM or Rackspace)</p> <p>Overview of Cloud Security - Security concerns in Traditional IT, Challenges in Cloud Computing in terms of Application, Server, and Network Security. Security reference model, Abuse and Nefarious Use of Cloud Computing, Insecure Interfaces and APIs (Malicious Insiders, Shared Technology Issues, Data Loss or Leakage, Account or Service Hijacking, Unknown Risk Profile), Attacks in Cloud Computing, Vendors offering Cloud Security for public and private clouds.</p> | 14 |
| III | <p>Overview of Multi-Cloud Management Systems - Explain concept of multi-cloud management, Challenges in managing heterogeneous clouds, benefits of multi-cloud management systems. Case study on Multi-Cloud Management System (Right Scale Cloud Management System)</p> <p>Business Clouds - Cloud Computing in Business, Various Biz Clouds focused on industry domains (Retail, Banking and Financial sector, Life Sciences, Social networking, Telecom, Education). Cloud Enablers (Business Intelligence on cloud, Big Data Analytics on Cloud), Role of Cloud computing in SCM and CRM. Future directions in Cloud Computing - Future technology trends in Cloud Computing with a focus on Cloud service models, deployment models, cloud applications, and cloud security. Migration paths for cloud, Selection criteria for cloud deployment. Current issues in cloud computing leading to future research directions.</p> | 13 |

Text Book:

- Raj Kumar Buyya, James Broberg, AndrezeiM.Goscinski (2011), Cloud Computing: Principles and paradigms.
- Anthony T. Velte, Toby J. Velte, and Robert Elsenpeter (2010) Cloud Computing: A Practical Approach, McGraw Hill.

Reference Books:

- Rittinghouse, John, W, Cloud computing: Implementation, management and security.
- Barrie Sosinsky (2011), Cloud Computing Bible, Wiley.
- Rhoton, John, Cloud Computing Architected: Solution Design Handbook.
- Krutz, Ronald L.; Vines, Russell Dean, Cloud Security, A comprehensive Guide to Secure Cloud Computing.

Course Outcome:

C01 Understand the recent trends of computing such as Grid computing, Cluster computing and Utility Computing

C02 Justify the need of new technology Cloud Computing and its ecological impact

C03 articulate the main concepts, key technologies, strengths, and limitations of cloud computing and the possible applications for state-of-the-art cloud computing

C04 Identify the architecture and infrastructure of cloud computing, including SaaS, PaaS, IaaS, public cloud, private cloud, hybrid cloud, etc.

C05 Understand the importance of protocols and standards in management for cloud services.

C06 Assess the comparative advantages and disadvantages of Virtualization technology.

C07 Assess the risk and security issues involved with their cloud computing Environment

C08 Increased availability of high-performance applications to small/ medium-sized businesses

MCAE0370: BIG DATA AND ANALYTICS LAB

Objective: This course introduces students to R, a widely used statistical programming language. Students will learn to manipulate data objects, produce graphics, analyse data using common statistical methods, and generate reproducible statistical reports. Student will also learn data mangling.

Credits: 01

L-T-P: 0-0-2

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I | <p>Module 1: Introduction to R</p> <ul style="list-style-type: none"> • Introduction and installation of R and RStudio • Data types, vectors, multidimensional array. • Functions and their use • Visualization using ggplot2. • Word-Count program using Java | 24 |
| II | <p>Module 2: Hands-On MongoDB, Cassandra</p> <ul style="list-style-type: none"> • Installation of VM-Ware and Cloudera • Hands-On Mongo DB: CRUD, Where, Aggregation • Hands-On Mongo DB: Projection, Aggregation • Hands-On Cassandra DB: CRUD, Projection | |
| III | <p>Module 3: Hands-On MapReduce</p> <ul style="list-style-type: none"> • Hands-On PIG • Hands-On HIVE • Twitter Data Fetching using Flume | |

Reference Books:

- Paul Teetor. R Cookbook: Proven recipes for data analysis, statistics, and graphics. O'Reilly Media, Inc.,2011.
- Norman Matloff. Theart of R programming: A tour of statistical software design. No Starch Press, 2011.
- Winston Chang. R graphics cookbook. O'Reilly Media, Inc., 2012.
- Hadley Wickham and Garrett Grolemund. R for data science. 2016.
- Phil Spector. Data manipulation with R. Springer Science& Business Media,2008.

Outcome:

At the end of the course,student is able to:

- CO1: Use R-Studio, read R documentation, and write R scripts.
- CO2: Import, export and manipulate data.
- CO3: Analyse the data using data analytics latest tools based on HDFS like Pig, Hive
- CO4: Implement the aggregation projection on data set using Cassandra, MongoDB.

MCAE0371: INTERNET OF THINGS LAB

Objective: Coordinate and help to increase and optimize the utilization of results and value creation in the area of IoT.

Credits: 01

L-T-P: 0-0-2

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I/II/III | <ul style="list-style-type: none"> • WAP to interface and blink the LED using Arduino UNO. • WAP to interface for different sensors (Like DHT11, temperature, IR, Ultrasonic etc) to Arduino UNO. • WAP to interface temperature sensor to ESP8266. Turn on the LED if temperature value met threshold value. • WAP to interface in between Bluetooth module and Arduino UNO. • Write a python program for Gateway to store sensor data on local MySQL database. • WAP to transmit the data wirelessly for longer distance using multi-hop technique. • Configure the gateway as local MQTT broker (Mosquitto), configure one ESP8266 as sender (Publisher), and receive the data on the Smartphone (MQTT Dashboard). | 12*2=24 |

Text Books:

- UpSkill Learning (2018), “ESP8266: Programming NodeMCU Using Arduino IDE - Get Started With ESP8266 (Internet Of Things, IOT, Projects In Internet Of Things, Internet Of Things for Beginners, NodeMCU Programming, ESP8266)”

Outcome: After completion of course, student will be able to:

- CO1: Students will be able to identifying the technical problems and be proficient in the analysis, design, test, and implementation of instrumentation and control systems utilizing appropriate software and hardware tools and devices.
- CO2: Understand the functionality of system components/devices for the automation of processes.

MCAE0372: CLOUD COMPUTING LAB

Objective: *This lab aims to understand the concept of cloud and virtualization by the help of VMware.*

Credits: 01

L-T-P: 0-0-2

| Module No. | Content | Lab Hours |
|------------|---|-----------|
| I/II/III | <ul style="list-style-type: none"> • 1. a) Introduction to Packet Tracer. • b) Network Topologies. (Including explanation of Simple PDU & Complex PDU.) • 2. Connecting 3 networks using routers. Also, configure DHCP and DNS server. • 3. Configuration of different Application services (SMTP, FTP, HTTP, TFTP, DHCP & DNS) • 4. Configuration of Vlan and Inter- Vlan Routing. • 5. Configure GRE over IP tunnel (VPN). • 6. Static NAT configuration. • 7. Configure Wireless network. • 8. Configure different IoT devices. • 9. Study on VMware <ul style="list-style-type: none"> • a. Creating a VM • b. Networking on VM • c. Merging and splitting disk on VM • d. Cloning the guest OS • e. Deploying VM with template • f. Creating Snapshots • g. Managing Users, Groups, Permissions and Roles • 10. Creating a EC2 instance on AWS • 11. Configuration of db in AWS. • 12. Creation of S3 bucket with single IAM user in AWS. | 12*2=24 |

MCAE0402: .NET FRAMEWORK USING C#

Objective: To understand the concepts of dot net framework and its technologies in programming.

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | Introduction of Dot Net Frame Work: Introduction, Architecture of Framework, Common Language Runtime and Architecture, Common Type System, Common Language Specification, The Base Class Library, Just-in-Time Compilation, Garbage Collection. Introduction of C# with Feature: Data Types, Identifiers, Variables & Constants, C# Statements, Object Oriented Concept, Object and Classes, Arrays and Strings, Delegates and Events, Properties and Indexer. | 15 |
| II | Input Output, Multi-Threading, Networking and Sockets, Unsafe Mode, Generic Classes, Unified Class, Error -handling. Assemblies: Its Feature and Structure, Types of Assembly - Private and Shared. | 14 |
| III | Advanced Concepts: Component Based and Web Based Application. Attribute: Built-In Attribute and Custom Attribute, ADO.NET, Web Services, Windows Services. Graphical Device Interface: Vector2D, Typography and Imaging, Anti-Aliasing. | 13 |

Text Books:

- Shibi Panikkar and Kumar Sanjeev (2009) "C# with .NET Framework". FirewallMedia.
- Shildt (2010) "C#: The Complete Reference. C#3.0", Tata McGraw Hill Publication.

Reference Books:

- Jeffrey Richter "Applied Microsoft .Net Framework Programming", Microsoft.
- Wiley (2011) "Professional C#", Wrox Publication.
- Shildt, "C#: The Complete Reference ADO.NET", Tata McGraw Hill Publication.

Outcome:

- The goal of this course is to help students to make learn the Microsoft .NET Framework with C# language.
- After completing this course students will be able to understand data-driven applications SQL Server and ADO.NET, building stand-alone applications, create web-based distributed applications and develop Real world Application using the .NET Framework, C#.

MCAE0403: MOBILE APPLICATION DEVELOPMENT

Objective: To gain a basic understanding of mobile platforms, emulators and mobile design principles.

Credits: 03

L-T-P-J :3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Preliminaries - Introduction & need for Mobile Apps development, Example, Mobility concept, Mobile structure and characteristics.</p> <p>Getting started with Mobility - Mobility landscape, Mobile platforms, Mobile apps development, Overview of Android platform, setting up the mobile app development environment along with an emulator, a case study on Mobile app development</p> <p>Building blocks of mobile apps - App user interface designing – mobile UI resources (Layout, UI elements, Draw-able, Menu), Activity- states and life cycle, interaction amongst activities.</p> | 14 |
| II | <p>App functionality beyond user interface - Threads, Async task, Services – states and life cycle, Notifications, Broadcast receivers, Telephony and SMS APIs</p> <p>Native data handling - on-device file I/O, shared preferences, mobile databases such as SQLite, and enterprise data access (via Internet/Intranet)</p> <p>Taking apps to Market - Versioning, signing and packaging mobile apps, distributing apps on mobile market place.</p> | 13 |
| III | <p>Sprucing up mobile apps - Graphics and animation – custom views, canvas, animation APIs, multimedia – audio/video playback and record, location awareness, and native hardware access (sensors such as accelerometer and gyroscope)</p> <p>Testing mobile apps - Debugging mobile apps, White box testing, Black box testing, and test automation of mobile apps, JUnit for Android, Robotium, MonkeyTalkCurrent trends in Mobile Apps development.</p> | 13 |

References:

- Barry Burd, Android Application Development All in one for Dummies, Edition: I
- Teach Yourself Android Application Development In 24 Hours, Edition: I, Publication: SAMS

Outcome:

At the end of this course, student shall be able to:

- Understand different mobile application models/architectures and patterns.
- Describe the components and structure of a mobile development framework
- Apply a mobile development framework to the development of a mobile application.
- Deploy applications to the Android OS

MCAE0404: DIGITAL MARKETING AND TRANSFORMATION

Objective: *The objective of this course is to provide knowledge about the digital marketing and the industry trends correspondence to the concepts.*

Credits: 03

L-T-P: 3-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Introduction to Digital Marketing Modern Marketing- How Marketing Works, Fundamentals Channels- Awareness, Consideration & Decision Making, Building Integrated Marketing Plan, Lead Journey- From Prospect to Sales.</p> <p>Website and Blogging The Power Of Storytelling, Know Your Customer - Market And Content Research, Construct Prospective Buyer Personas & Journeys, Establishing The Content Ideation & Creation Framework, Creative Design Principles, Linking Blogs To Social Network (Conversation Blogs), Measuring And Optimizing Blog Performance, Importance Of Responsive Design, Leverage Landing Pages And Forms To Accelerate Conversion.</p> <p>Content Promotion SEO as an Art and as a Science, Ranking Algorithms, Website Audit, Optimizing Digital Assets & Metadata, Decoding Common Paid Media Platforms, Influencer Marketing, Black Hat, White Hat and Grey Hat SEO</p> <p>Email Marketing Types of Email (Promo/Trans/NL), ESP Setup & On-boarding, Permission Marketing, Subscriber welcome plan and journey, List segmentation and Management, Personalization and Responsive design, Multivariate Testing, E-commerce Integration, Deliverability and System reputation Management, System Integrations & Automations.</p> | 14 |
| II | <p>Social Media Marketing Social Ads Type and their Design Structure, Targeting strategy and planning – Laser/Broad, Effective targeting and custom audience set-up, Campaign setup and reporting on various social platforms, Social Split Advertising, Content Calendar, Peremptory traits for Social Advertising PPE, WC and CTW campaigns.</p> <p>Mobile Marketing Mobile landscapes for Marketing and Monetization, Conventional Advertising, Millennial Mobile Advertising, Versatile Promotions, Alternative focusing and promotions on Mobile, Push App and Game based promotions, Location evolution with mobile</p> <p>Marketing Analytics & ROI Key marketing engagement & ROI metrics, Primer on data science and analytics concepts, Web Traffic nuances, Multi-channel Analytics, Decoding CLV and RFM, Deciphering conversion and goal metrics, Implement conjoint analysis & decision tree tactics, Avoiding common analytical pitfalls.</p> | 13 |

Text Book:

- Philip Kotler, Hermawan Kartajaya, Iwan Setiawan, Marketing 4.0 : Moving from Traditional to Digital, , Publication Wiley India Pvt Ltd.

Reference Books:

- Ian Dodson, The Art of Digital Marketing: The Definitive Guide to Creating Strategic, Targeted and Measurable Online Campaigns, Publication Wiley India Pvt Ltd.
- Puneet Singh Bhatia, Fundamentals of Digital Marketing First Edition, Publication Pearson.
- Vandana Ahuja, Digital Marketing 1st Edition, Publication Oxford.
- Rohan Yamagishi, Digital Marketing in Asia : A Start-Up Guide for Search Engine Marketing in APAC, Publication R. R. Bowker

Course Outcome:

CO 1: Explain the role and importance of digital marketing in a rapidly changing business landscape..

CO 2: Describe and implement various methods for content promotion and website blogging.

CO 3: Understand the major digital marketing channels – email marketing.

CO 4: Describe the major social media marketing strategies that can be used to promote a company, brand, product, service or person.

CO 5: Understand mobile within digital marketing to develop your own mobile marketing strategies.

CO 6: Learn the measurement techniques used in evaluating digital marketing efforts and ROI.

MCAE0471: .NET FRAME WORK LAB

Objective: To implement various concepts of dot net framework technologies in algorithms.

Credits: 02

L-T-P-J: 0-0-4-0

| Module No. | Content | Lab Hours |
|-------------------|--|------------------|
| I | <ul style="list-style-type: none">Working with OOPS concepts.Code access security with C#. (Properties and Indexers).Working with Delegates and Events on Console.File handling with C#.Working with multiple threads.Using System.Net Web Client to retrieve or upload Data with C#.Client Server Networking with TCP, UDP and Socket.Working with Page and Forms using ASP.NET.Data Base access model (Working with ADO.NET).Creating Web Service and Consume in web based application. | 48 |

Outcome:

At the end of the course, students will be able to:

- Explain the principles of object-oriented programming.*
- Write clear and effective C# code.*
- Access data using ADO.NET.*
- Develop web applications using ASP.NET Web Forms.*
- Develop and use ASP.NET Web Services.*

MELH0007: ETHICS & VALUES

Objective: To understand the basic issues and challenges that Indian society is facing today and analyze the impact of technology on individuals, groups and societies.

Credits: 02

L-T-P-J: 2-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Conceptual Foundations: Foundations of Morality, Professional Ethics, Professional Standards In Engineering Practice, Major Theories Of Ethics and Different Ethical Approaches, Normativity of Science and Technology.</p> <p>Professions And Moral Dilemmas: Contemporary Ethical Issues, Conflict Of Interests, Contracts, Rights And Violations, Consent And Dissent; Privacy And Confidentiality, Consultancy, Allocation Of Burdens And Benefits, Direct And Indirect Responsibility, Patents, Piracy and Clones.</p> | 18 |
| II | <p>Decision Making :Theoretical Bases, Foundational Values, Greater Welfare Approach, Risk-Benefit Analysis, Right-based Approach, Priority Allocation, Binding Grounds of Decisions, Public Norms and Professional Guidelines.</p> <p>Social Responsibility: Individual and Collective Responsibility, Corporate Social Responsibility, Justice and Fairness, Beneficence and Safety, Respect for Humanity, Life, and Nature, Sustainable Development.</p> | 18 |

References:

- Sandel M. J., Justice: What's Right Thing To Do? , Penguin Books, 2010

Outcome: At the end of the course, students will be able to:

- Define business in ethical context and identify challenges in ethical decision making.
- Know corporate social responsibility in Indian context and will be able to discuss the issues arising there from.
- Understand the basics of important laws such as factory act, Consumer protection act, IT act, RTI act.

BCHS0201: ENVIRONMENTAL STUDIES

Objective: To create awareness towards various environmental issues like global warming, urbanization, pollutions, ozone layer depletion etc; their causes and remedial steps for protecting impacted society.

Credits: 02

L-T-P-J: 2-0-0-0

| Module No. | Content | Teaching Hours |
|------------|--|----------------|
| I | <p>Basics of Environmental Studies:</p> <p>Environment: Concept, Types, Introduction, Multidisciplinary Nature, Scope, Importance, Need of Creating Public Awareness about Environment, Environmental Education, Environmental Ethics.</p> <p>Natural Environment: Life on the Earth, Structure & Function of Atmosphere, Hydrosphere, Lithosphere and Biosphere.</p> <p>Human Activities and their Effects on Environment: Effect of Agriculture, Housing, Mining, Transportation and Industries.</p> <p>Ecosystem and Natural Resources</p> <p>Ecology and Ecosystem: Definitions, Structure & Functions. Biodiversity: Status, Distribution, Depletion and Conservation.</p> <p>Natural Resources: Introduction, Classification, Depletion, Conservation, Status and Challenges related to Water Resources, Mineral Resources and Forest Resources.</p> | 19 |
| II | <p>Status and Challenges related to Energy Resources: Fossil Fuels, Hydroelectricity, Nuclear Energy, Solar Energy, Biomass Energy and Other Alternative Energy Resources.</p> <p>Environmental Problems and Protection</p> <p>Environmental Pollution: Causes, Effects and Control of Air Pollution, Water Pollution, Land Pollution and Noise Pollution. Solid Wastes and Hazardous Wastes: Introduction and Management.</p> <p>Global Environmental Challenges: Global Warming, Ozone Layer Depletion, Acid Rain, Urbanization and Overpopulation.</p> <p>Environmental Protection: Role of Citizens, Role of NGOs, Role of Government, Role of International Agencies and Conventions.</p> <p>Tools of Environmental Protections: Environmental Laws, Environmental Impact Assessment, ISO Certification, Environmental Economics, Concept of Ecological Footprints and Sustainable Development, Major Environmental Problems and Efforts towards Environmental Protection in India.</p> | 18 |

Text Book:

- S. Deswal & A. Deswal "Environment and Ecology", 1st edition, Danpat Rai & Co. Ltd.

Reference Books:

- Anubha Kaushik "Perspective in Environmental Studies" 5th edition New Age International Publishers New Delhi.
- Benny Joseph "Environmental Studies" 2nd edition Tata McGraw-Hill Education New Delhi.
- R.K. Agrawal and V.K. Sangal "Environment and Ecology" 1st edition Krishna Prakashan Media.
- Ralph Homes, Tim Grant, Karli Verghese "Life Cycle Assessment: Principle, Practice and Prospects" CSIRO PUBLISHING (20 March 2009) Australia.
- G. Miller "Environmental Science: Working with the Earth" 11th edition, Thomson Brooks/Cole; (October 11, 2005).
- A.K. De "Environmental Studies" bhartiya vidyapeeth institute of Environmental Education and Research Pune.

Outcome:

- Students will be able to understand the environmental issues pertaining to day-to-day living; gain awareness for the need of environmental education vis-à-vis education for sustainable development.
- Students will acquire knowledge in ecological perspective and value of environment, biotic components, ecosystem process: energy, food chain, water cycle etc.
- Students will be able to understand water quality standards and parameters, assessment of water quality, air pollution, pollutants, acid rain, global climate change and green house gases.
- Students will learn to understand variety of social issues associated with environmental deterioration involving human components such as population, ethics and urban settlements.

MCAE0305: INTERNET OF THINGS

Objective: To Implement Data and Knowledge Management and use of Devices in IoT Technology.

Credits: 03

L-T-P: 3-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction to IoT: Introduction to IoT- Sensing, Actuation, Logical design of IoT, Functional blocks of IoT, Communication models, IoT & M2M: Machine to Machine, Difference between IoT and M2M,</p> <p>Introduction to Sensors: About Sensor, Properties of Sensors, Basic physical principles of sensing, Categorization of Sensor, PIR Sensor, Temperature Sensor, Ultrasonic Sensor, IR Sensor, MQ2/MQ3</p> | 14 |
| II | <p>Implementing IoT Introduction to different IoT Tools, Introduction to Arduino Programming. Integration of Sensors and Actuators with Arduino. Implementation of IoT with Arduino, Node MCU and Raspberry Pi. Mini project Statement using Node MCU.</p> | 13 |
| III | <p>IoT Over Network IOT Networking Protocols: TCP/IP, 6LowPan, RPL, Thread. Communication Protocol: CoAP, SMTP, HTTP, HTTPS, MQTT, MQTT-S SDN for IoT, Implementing web server. Tools for data handling using web services. Data Handling and Analytics in Cloud and Fog Computing.</p> | 14 |

Reference Books:

- Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", (CRC Press)
- ArshdeepBahga and Vijay Madiseti "Internet of Things: A Hands-on Approach", by (Universities Press)

Outcome: After completion of Lab, student will be able to:

- CO1: Understand the concepts of Internet of Things.
- CO2: Analyze basic protocols in IOT.
- CO3: Design IoT applications in different domain and be able to analyze their performance.
- CO4: Able to implement basic IoT applications on embedded platform.

MCAE0371: INTERNET OF THINGS LAB

Objective: Coordinate and help to increase and optimize the utilization of results and value creation in the area of IoT.

Credits: 01

L-T-P: 0-0-2

| Module No. | Content | Lab Hours |
|------------|--|-----------|
| I/II/III | <ul style="list-style-type: none"> • WAP to interface and blink the LED using Arduino UNO. • WAP to interface for different sensors (Like DHT11, temperature, IR, Ultrasonic etc) to Arduino UNO. • WAP to interface temperature sensor to ESP8266. Turn on the LED if temperature value met threshold value. • WAP to interface in between Bluetooth module and Arduino UNO. • Write a python program for Gateway to store sensor data on local MySQL database. • WAP to transmit the data wirelessly for longer distance using multi-hop technique. • Configure the gateway as local MQTT broker (Mosquitto), configure one ESP8266 as sender (Publisher), and receive the data on the Smartphone (MQTT Dashboard). | 12*2=24 |

Text Books:

- UpSkill Learning (2018), “ESP8266: Programming NodeMCU Using Arduino IDE - Get Started With ESP8266 (Internet Of Things, IOT, Projects In Internet Of Things, Internet Of Things for Beginners, NodeMCU Programming, ESP8266)”

Outcome: After completion of course, student will be able to:

- CO1: Students will be able to identifying the technical problems and be proficient in the analysis, design, test, and implementation of instrumentation and control systems utilizing appropriate software and hardware tools and devices.
- CO2: Understand the functionality of system components/devices for the automation of processes.

MCAE0202: MACHINE LEARNING

Objective:

Credits: 03

L-T-P-J: 3-0-0-0

| Module No. | Content | Teaching Hours |
|------------|---|----------------|
| I | <p>Introduction: Machine Learning basics, Hypothesis space and inductive bias, training and test set, and cross-validation.</p> <p>Introduction to Statistical Learning: Bayesian Method.</p> <p>Machine Learning: Supervised (Regression, Classification) vs. Unsupervised (Clustering) Learning.</p> <p>Data Preprocessing: Imputation, Outlier management, One hot encoding, Dimensionality Reduction- feature extraction, Principal Component Analysis (PCA), Singular Value Decomposition</p> <p>Supervised Learning: Regression- Linear regression, Polynomial regression, Classification- Logistic regression, k-nearest neighbor classifier,</p> | 20 |
| II | <p>Supervised Learning: Decision tree classifier, Naïve Bayes classifier Support Vector Machine (SVM)Classifier,</p> <p>Unsupervised Learning: k-means clustering, Hierarchical clustering</p> <p>Underfitting vs Overfitting: Regularization and Bias/Variance.</p> <p>Ensemble methods: Bagging, Boosting, Improving classification with Ada-Boost algorithm.</p> | 20 |

Text Book:

- Tom M. Mitchell (2013), *Machine Learning*. Tata McGraw-Hill Education.
- Alpaydin, E. (2009). *Introduction to machine learning*. MIT press.

Reference Books:

- Harrington, P. (2012). *Machine learning in action*. Shelter Island, NY: Manning Publications Co.
- Bishop, C. M. (2006). *Pattern recognition and machine learning (information science and statistics)* springer-verlag new york. Inc. Secaucus, NJ, USA.

Outcome: After completion of Lab, student will be able to:

- CO1: Apply the basic concepts of machine learning.
- CO2: Apply the concepts of regression and re-sampling methods.
- CO3: Design supervised and re-enforcement learning based solution.
- CO4: Apply the ensemble methods for improving classification.
- CO5: Identify the ways of feature extraction, reduction and selection.
- CO6: Design the applications of machine learning algorithms.

| S.No | PROGRAM |
|-------------|---|
| 1 | Estimate parameters of a model based on Linear Regression method using a given set of training data set. |
| 2 | Estimate parameters of a model based on maximum likelihood estimation method using a given set of training data set. |
| 3 | Compute weights of ANN based on back propagation method using a given training dataset. |
| 4 | Compute probability of a person to be diabetic based on a given dataset of diabetic persons using Naïve Bayesian classifier. |
| 5 | Classify a person as male or female based on a given dataset using naïve Bayesian Classifier, and calculate accuracy, precision, and recall for your data set. |
| 6 | Write a program to implement k -Nearest Neighbour method to classify the iris data set. Print both correct and wrong predictions. Use Java/Python ML library classes |
| 7 | Predicts whether the bank should approve the loan of an applicant, based on his profile using Ensemble learning method. |
| 8 | Apply Ensemble learning to cluster a set of data stored in a .CSV file. Use the same dataset for clustering using k -Means method. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program. |
| 9 | The stock prediction data is used to predict, whether the stock will go up or down. Perform the task of feature selection with the help of wrapper method. |
| 10 | Identify principal components of Big Mart sales data using Principal component analysis (PCA). Also plot the result of PCA, and give inferences. |

MCAE0272: MACHINE LEARNING LAB

Credits: 01

L-T-P-J: 0-0-2-0

Outcome: After studying the subject, the students will be able to:

- CO1: Apply the machine learning algorithms in the area of text, audio and image processing.
- CO2: Apply classification algorithms to design complex problems.
- CO3: Design solution to societal issues using machine learning algorithms.
- CO4: Analyze the view problem in the perspective of machine learning.

Mapping of Course Outcomes (COs) with Program Outcomes (POs) and Program Specific Outcomes (PSOs):

| CO | PO/PSO |
|-----------|------------------------|
| CO1 | PO3,PO5/PSO4 |
| CO2 | PO1,PO5/PSO1,PSO3,PSO4 |
| CO3 | PO3 /PSO1,PSO2,PSO4 |
| CO4 | PO2,PO3/PSO1,PSO2,PSO4 |