

DATA STRUCTURES

Subject Code: MCAPS1-201

L T P C
3 1 0 4

Duration: 60 Hrs.

Course Objectives

1. A study of advanced programming topics focused on logical structures of data, their physical representation, design and analysis of algorithms operating on the structures, and techniques for program development and debugging.
2. Emphasis is placed on the appropriate use and choice of standard data structures.

UNIT-I (17 Hrs.)

Introduction to Data Structure - Concept of data, Problem analysis, Data structures and Data structure operations, Notations, Mathematical notation and Functions, Algorithmic Complexity, Big-O Notation and time space trade off.

Arrays - Overview of Arrays, Recursion, Pointers, Pointer Arithmetic, Array of pointers, Arrays in terms of pointers, Static and Dynamic Memory Management, Garbage Collection, Understanding and Implementation of Various Data Structures with Applications.

Stack - Operations like Push, Pop and Various Applications like Conversion from Infix to postfix and prefix expressions, Evaluation of postfix expression using stacks.

Queues - Operations like Enqueue, Dequeue on Simple, Circular and Priority Queues.

Linked Lists - Operations like Creations, Insertion, Deletion, Retrieval and Traversal on Single, Circular and doubly linked list.

UNIT-II (15 Hrs.)

Trees - Definitions and Concepts: Root Node, Leaf Node, Level, Degree, Height and Tree representation using linked List and array.

Tree Operations - Creation, Insertion, Deletion and Traversals (Preorder, In-order, Postordered) and searching on various types of trees. Types of Trees: Binary trees, Binary search tree, Height balanced (AVL) tree, B trees, B+ Tree.

Heap - Definition, Structure, Algorithms and applications.

UNIT-III (14 Hrs.)

Graphs - Graph definitions and Concepts: Edge, Vertices, and Graph representation using Adjacency matrix, Adjacency lists. Types of graphs: Weighted, Unweighted, Directed, Undirected Graphs. Graph Operations: Creation, Insertion, Deletion, Traversals and Searching (Depth first, Breadth-first) of various types of graphs and Dijkstra's algorithm for shortest distance calculation.

UNIT- IV (14 Hrs.)

Sorting - Concepts, Order, Stability and Efficiency of various algorithms (Selection Sort, Bubble Sort, Insertion Sort, Merge Sort, Quick Sort, Heap Sort and Radix Sort).

Searching - Concept and Efficiency of linear and binary search algorithms.

Hashing - Definition, Implementation and Applications.

Recommended Books

1. Seymour Lipschutz, 'Data Structures', 1stEdn., McGraw Hill Education, **2014**.
2. E. Horowitz, and S. Sahni, 'Fundamentals of Data Structures in C++', 2ndEdn., Galgotia Publications Pvt. Ltd., **1999**.
3. A.V. Aho, Hopcroft, J.D. Ullman, 'Data Structures and Algorithms', 1stEdn., Pearson, **1983**.
4. Tanenbaum, 'Data Structures using C', 2ndEdn., Prentice Hall International, **2015**.

MRSPTU MCA SYLLABUS 2020 BATCH ONWARDS

OPERATING SYSTEM

Subject Code: MCAPS1-202

**LTPC
3104**

Duration: 60 Hrs.

Course Objectives

After completion of this course, the students would be able to:

1. Understand functions, Role, different structures and views of Operating system.
2. Understand Process management in operating system.
3. Understand Memory Management in operating system.
4. Understand Device Management in operating system.

UNIT-I (17 Hrs.)

Introduction - Introduction to Operating system, Role of Operating System as resource manager, function of kernel and shell, operating system structures, views of an operating system.

UNIT-II (14 Hrs.)

Process management - CPU scheduling, Scheduling Algorithms, PCB, Process synchronization, Deadlocks, Prevention, Detection and Recovery

UNIT-III (14 Hrs.)

Memory Management - Overlays, Memory management policies, Fragmentation and its types, Portioned memory managements, Paging, Segmentation, Need of Virtual memories, Page replacement Algorithms, Concept of Thrashing

UNIT-IV (15 Hrs.)

Device Management - I/O system and secondary storage structure, Device management policies, Role of I/O traffic controller, scheduler, File Management: File System Architecture, Layered Architecture, Physical and Logical File Systems, Protection and Security, Brief study to multiprocessor and distributed operating systems. Case Studies: LINUX / UNIX Operating System and Windows based operating systems. Recent trends in operating system.

Recommended Books

1. A. Silberschatz and Peter B. Galvin, 'Operating System Concepts', 2ndEdn., Wiley, 2013.
2. Dhananjay M. Dhamdhare, 'Operating Systems', 1stEdn., McGraw Hill, 2008.
3. Gary Nutt, 'Operating Systems Concepts', 2ndEdn., McGraw Hill, 2001.
4. Stuart E. Madnick and John J. Donovan, 'Operating Systems', 1stEdn., McGraw Hill, 1974.
5. William Stallings, 'Operating Systems: Internals and Design Principles', 6thEdn., PrenticeHall, 2008.

DISCRETE MATHEMATICS

Subject Code: MCAPS1-203

**L T P C
3 0 0 3**

Duration: 45 Hrs.

Course Objectives

1. To learn the ability to distinguish between the tractability and intractability of a given computational problem.
2. To be able to devise fast and practical algorithms for real-life problems using the algorithm design techniques and principles learned in this course.

UNIT-I (11 Hrs.)

Sets, Relations and Functions: Introduction, Combination of Sets, ordered pairs, proofs of general identities of sets, relations, operations on relations, properties of relations and functions, Hashing Functions, equivalence relations, compatibility relations, partial order relations.

Basic Logic: Propositional logic, Logical connectives, Truth tables, Normal forms (conjunctive and disjunctive), Validity of well-formed formula, Propositional inference rules (concepts of modus ponens and modus tollens), Predicate logic, Universal and existential quantification, Limitations of propositional and predicate logic.

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UNIT-II (10 Hrs.)

Combinatorial Mathematics: Basic counting principles Permutations and combinations Inclusion and Exclusion Principle Recurrence relations, Generating Function, Application.

UNIT-III (12 Hrs.)

Probability Distributions: Probability, Bayes theorem, Discrete & Continuous probability distributions, Moment generating function, Probability generating function, Properties and applications of Binomial, Poisson and normal distributions.

Graph Theory: Graph- Directed and undirected, Eulerian chains and cycles, Hamiltonian chains and cycles Trees, Chromatic number Connectivity, Graph coloring, Plane and connected graphs, Isomorphism and Homomorphism. Applications.

UNIT-IV (12 Hrs.)

Monoids and Groups: Groups Semigroups and monoids Cyclic semigroups and submonoids, Subgroups and Cosets. Congruence relations on semigroups. Morphisms. Normal subgroups. Dihedral groups.

Rings and Boolean Algebra: Rings, Subrings, morphism of rings ideals and quotient rings. Euclidean domains Integral domains and fields Boolean Algebra direct product morphisms Boolean sub-algebra Boolean Rings Application of Boolean algebra (Logic Implications, Logic Gates, Karnaugh map)

Recommended Books:

1. Lipschutz, 'Discrete Mathematics (Schaum Series)', 3rdEdn., McGraw Hill, 2009.
2. Alan Doerr and Kenneth Levarseur, 'Applied Discrete Structures for Computer Science', Galgotia Publications, 2009.
3. N. Ch SN Iyengar, V.M. Chandrasekaran, 'Discrete Mathematics', 1stEdn., Vikas Publication House, 2003.
4. S. Santha, 'Discrete Mathematics and Graph Theory', 1stEdn., Cengage COURSE.
5. Kenneth H. Rosen, 'Discrete Mathematics and its Applications', 7thEdn., McGraw Hill, 2008.
6. C.L. Liu, 'Elements of Discrete Mathematics', 4thEdn., McGraw Hill, 2012.
7. Satinder Bal Gupta, 'Discrete Mathematics and Structures', 4thEdn., Laxmi Publications, 2008.

SOFTWARE LAB. – III (DATA STRUCTURES)

Subject Code: MCAPS1-204

**L T P C
0 0 4 2**

This laboratory course will comprise as exercises to supplement what is learnt under paper MCAPS1-201.

SOFTWARE LAB. – IV (OPERATING SYSTEM)

Subject Code: MCAPS1-205

**L T P C
0 0 4 2**

This laboratory course will comprise as exercises to supplement what is learnt under paper MCAPS1-202. Students are required to do at least 8 assignments based on the paper.

DATA WAREHOUSING AND DATA MINING

Subject Code: MCAPD1-211

**L T P C
3 0 0 3**

Duration: 45 Hrs.

Course Objectives

After completion of this course, the students would be able to:

1. Understand operational database, data ware housing, need of database to meet industrial needs.

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2. Identify the components in typical data warehouse Architecture and understand the multidimensional schemas for data warehouse.
3. Understand the knowledge about data mining, decision tree, generic algorithms and Fuzzy set approach.

UNIT – I (10 Hrs.)

Review of Data Warehouse- Need for strategic information, Decision support system, Knowledge discovery & decision making, need for data warehouse, Data warehousing and data mining, common characteristics of Data warehouse, Data Marts, Metadata, Operational versus analytical databases, trends and planning of Data warehousing.

UNIT - II (11 Hrs.)

Schemas and Architecture of Data warehouse- Multidimensional data model, Data cubes, Schemas for Multidimensional Database: stars, snowflakes and fact constellations. Data warehouse process & architecture, OLTP vs. OLAP, ROLAP vs. MOLAP, types of OLAP servers, 3-Tier data warehouse architecture, distributed and virtual data warehouses, data warehouse manager.

UNIT – III (12 Hrs.)

Introduction to Data Mining- Data mining definition & task, KDD versus Data mining, Techniques, Tools and Applications of Data mining. Data mining query languages, data specification, specifying knowledge, hierarchy specification, pattern presentation & visualization specification.

Data Mining Techniques- Association rules, Clustering techniques, Decision tree knowledge discovery through neural.

UNIT – IV (12 Hrs.)

Data Mining Classification- Networks & Genetic Algorithms, Rough Sets, Support Vector Machines and Fuzzy techniques. Mining Complex data objects, Spatial databases, Multimedia databases, Time series and Sequence data, mining Text Data bases and mining Word Wide Web.

Recommended Books:

1. Jiawei Han, Micheline Kamber, Jian Pei, 'Data Mining: Concepts and Techniques', 3rdEdn., Morgan Kaufmann, 2011.
2. George M. Marakas, 'Modern Data Warehousing, Mining, and Visualization', 1stEdn., Prentice Hall, 2001.
3. Elzbieta Malinowski and Esteban Zimanyi, 'Advanced Data Warehouse Design: From Conventional to Spatial and Temporal Applications (Data-Centric Systems and Applications)', 1stEdn., Springer, 2008.
4. Matteo Golfarelli and Stefano Rizzi, 'Data Warehouse Design: Modern Principles and Methodologies', 1stEdn., McGra Hill Education, 2009.
5. Alex Berson and Stephen J. Smith, 'Data Warehousing, Data Mining, & OLAP', 1stEdn., Tata McGraw Hill, 1997.

BUSINESS INTELLIGENCE AND DIGITAL MARKETING

Subject Code: MCAPD1-212

**L T P C
3 0 0 3**

Duration: 45 Hrs.

Course Objectives

After completion of this course, the students would be able to:

1. Understand the role of business intelligence and digital marketing within an organization.
2. Use decision-making tools/Operations Research techniques and manage business processes using analytical and management tools.
3. Analyse and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

UNIT – I (12 Hrs.)

Introducing the Technical Architecture- The value of architecture, Technical Architecture overview, Back room Architecture, Presentation Server Architecture, Front room Architecture, Infrastructure, Metadata, and Security.

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Introducing Dimensional Modeling- Making the Case for Dimensional Modeling, Dimensional Modeling primer, Enterprise Data Warehouse Bus Architecture, More on Dimensions & Facts.

UNIT – II (10 Hrs.)

Designing the Dimensional Modeling- Modeling Process overview, Getting Organized, Four Step Modeling Process, Design the Dimensional Model.

UNIT – III (11 Hrs.)

Introducing Extract, Transformation & Load- Round up the requirements, the 34 subsystems of ETL, Extracting Data, Cleaning & Conforming data.

Introducing Business Intelligence Applications- Importance of B.I., Applications, Analytical cycle for B.I., Types of B.I. Applications, Navigating Applications via the B.I. portal.

UNIT – IV (12 Hrs.)

Designing & Developing B.I. Applications- B.I. Application resource planning, B.I. Application Specification, B.I. Application Development, B.I. Application maintenance.

Recommended Books

1. Sam Anahory and Dennis Murray, 'Data Warehousing in the Real World: A Practical Guide for Building Decision Support Systems', 1stEdn., Addison Wesley Longman Ltd., **1997**.
2. Ralph Kimball and Margy Ross, 'The Data Warehouse Toolkit: The Definitive Guide to Dimensional Modelling', 3rdEdn., Wiley, **2013**.
3. Micheline Kamber, Jian Pei, 'Data Mining: Concepts and Techniques', 3rd Edn., Morgan Kaufmann, **2011**.
4. R.N. Prasad and Seema Acharya, 'Fundamentals of Business Analytics', 1stEdn., Wiley, **2011**.

SOFTWARE TESTING AND QUALITY ASSURANCE

Subject Code: MCAPD1-213

L T P C
3 0 0 3

Duration: 45 Hrs.

Course Objectives

After completion of this course, the students would be able to:

1. Analyse different approaches to software testing and quality assurance, and select optimal solutions for different situations and projects;
2. Conduct independent research in software testing and quality assurance and apply that knowledge in their future research and practice;
3. Evaluate the work of peers constructively by following proven methods of peer-review, and by using the principles of research ethics.

UNIT-I (10 Hrs.)

Testing Principles- Need of testing, Basic concepts—errors, faults, defects, failures, test bed, unit testing, integration testing system, system testing, regression testing, alpha, beta and acceptance testing, functional testing, performance testing, white box testing, black box testing, verification and validation.

UNIT-II (12 Hrs.)

Test Management- Testing Life Cycle—Roles and activities, Test Planning, Develop test plan review, Test Cases design strategies. Black box approach: random testing, equivalence class partitioning and boundary value analysis. White box approach: test adequacy criteria, coverage and control flow graphs, paths, loop testing, mutation testing.

UNIT-III (12 Hrs.)

Software Metrics- Scope of software metrics, Classifying software measures, Measurement basics – representational theory, scales, meaningfulness, What to measure—GOM technique, Control flow structure, product quality metrics – MTTF, defect density, customer problems, customer satisfaction, function point.

Quality Assurance- Quality concepts—quality, quality control, quality assurance, cost of quality Software quality assurance – SQA activities, software reviews, inspections, audits, Software reviews, inspections,

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audits, Software reliability Quality Attributes: correctness, reliability, usability, integrity, portability, maintainability, interoperability. Ishikawa's Seven Basic Tools.

UNIT-IV (11 Hrs.)

Quality Standards- Basic concept of–ISO 9000 & 9001, CMM, six sigmas.

Development of CMM- CMM–Following KPAs: requirements management (RM), software project tracking and oversight (SPTO), software configuration management (SCM), organization process definition (OPD), software product engineering (SPE), peer reviews (PR), quantitative process management (QPM), process change management.

Recommended Books:

1. Kshirasagar Naik and Priyadarshi Tripathy, 'Software Testing and Quality Assurance: Theory and Practice', 1st Edn., Wiley, 2008.
2. Jeff Tian, 'Software Quality Engineering: Testing, Quality Assurance, and Quantifiable, Improvement', 1st Edn., Wiley, 2005.
3. William E. Perry, 'Effective Methods for Software Testing: Includes Complete Guidelines, and Checklists', 3rd Edn., Wiley, 2006.
4. Glenford J. Myers, 'The Art Of Software Testing', 3rd Edn., Wiley, 2015.

PROGRAMMING IN JAVA

Subject Code: MCAPD1-221

LTPC
3003

Duration: 45 Hrs.

Course Objectives

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

1. Use the Java programming language in the development of small application programs that demonstrate professionally acceptable coding and performance standards.
2. Understanding of the basic principles of the object oriented development process and apply this understanding to the analysis and design of solutions for small scale problems.
3. Work with the JDBC technology and learn Java Generics and the development of Projects.

UNIT-I (11 Hrs.)

Introduction- Object Oriented Concept, Features and Applications of Java, Differences between Java and C++, Structure of Java Program, Literals, Tokens, Keywords, Constants, Variables & Data types, Scope of variables, Operators, Expressions, Flow control statements. Arrays, Vectors, Type Conversion, Command Line Arguments, Access specifiers, Constructors, Inheritance, Static Classes, Abstract Classes, Final Classes, Wrapper Classes, Garbage Collection & Finalize method, Handling String and String Buffer classes, Method Overloading and Overriding.

UNIT-II (11 Hrs.)

Interfaces & Packages- Introduction, implementing multiple inheritance through Interfaces, Packages, Multithreaded Programming.

Exception Handling- Introduction, Handling System defined Exceptions, Creating and handling user defined exceptions.

Managing I/O- Introduction to streams, Handling and using various Stream Classes.

UNIT-III (11 Hrs.)

Applets- Introduction to Applets, Types of Applets, Using Applet Applications, Passing Parameters to Applets.

Introduction to Graphic Programming- Applying 2-D transformations on Objects, Event Handling, Layouts, Frames, Panels, JDBC.

UNIT-IV (12 Hrs.)

Advanced Programming- Servlet Programming (Servlet Life Cycle, Generic Servlet, HttpServlet, HttpServletRequest, HttpServletResponse, Service method, doGet method, doPost method, Servlet Exception).

Recommended Books

1. Y. Daniel Liang, 'Introduction to Java Programming', 9th Edn., Pearson, 2011.

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- HerbetSchildt, 'Java 2: The Complete Reference', 5thEdn., McGraw Hill, **2002**.
- Gary Cornell and Cay S. Horstmann, 'Core Java, Volume 2- Advanced Features', 8thEdn., Pearson, **2008**.
- Ed Roman, Rima Patel and Gerald Brose, 'Mastering Enterprise Java Beans', 3rdEdn., JohnWiley& Sons Inc., **2004**.

PROGRAMMING WITH PYTHON

Subject Code: MCAPD1-223

LTPC

Duration: 45 Hrs.

3003

Course Objectives

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

- Master the fundamentals of writing Python scripts and Learn core Python scripting elements such as variables and flow control structures.
- Discover how to work with lists and sequence data
- Write Python functions to facilitate code reuse
- Use Python to read and write files and Work with the Python standard library

UNIT-I (11 Hrs.)

Introduction to Python: Installing Python, Simple program using Python, Expressions and Values, Variables and Computer Memory, error detection, Multiple line statements, Designing and using functions, functions provided by Python, Tracing function calls in memory model, omitting return statement. Working with Text: Creating Strings of Characters, Using Special Characters in Strings, Creating a Multiline String, Printing Information, Getting Information from the Keyboard.

UNIT- II (11Hrs.)

A Boolean Type: A Boolean Type, Choosing Statements to Execute, Nested If Statements, Remembering the Results of a Boolean Expression Evaluation, A Modular Approach to Program Organization, Importing Modules, Defining Your Own Modules, Testing Code Semi automatically Grouping Functions Using Methods: Modules, Classes, and Methods, Calling Methods the Object-Oriented Way, Exploring String Methods, Underscores.

UNIT- III (12Hrs.)

Storing Collections of Data Using Lists: Storing and Accessing Data in Lists, modifying Lists, Operations on Lists, Slicing Lists, Aliasing, List Methods, Working with a List of Lists. Repeating Code Using Loops: Processing Items in a List, Processing Characters in Strings, Looping Over a Range of Numbers, Processing Lists Using Indices, Nesting Loops in Loops, Looping Until a Condition Is Reached, Repetition Based on User Input, Controlling Loops Using Break and Continue Reading and Writing.

UNIT- IV (11Hrs.)

File Operation: Reading config files in python Writing log files in python Understanding read functions, read (), read line () and read lines () Understanding write functions, write () and writelines () Manipulating file pointer using seek Programming using file operations.

Recommended Books:

- Downey, Allen B. Think Python: How to Think Like a Computer Scientist (Version 1.6.6 Ed.),**2012**.
- Hamilton, Naomi. "The A-Z of Programming Languages: Python",**2008**.
- Lutz, Mark Learning Python (5th ed.). O'Reilly Media,**2013**.
- Pilgrim, Mark Dive into Python 3. Apress,**2009**.

**SOFTWARE LAB. – V
(PROGRAMMING IN JAVA)**

Subject Code: MCAPD1-222

**LTPC
0042**

This laboratory course will comprise as exercises to supplement what is learnt under paper MCAPD1-221.

**SOFTWARE LAB. – VI
(PROGRAMMING WITH PYTHON)**

Subject Code: MCAPD1-224 LTPC

0042

This laboratory course will comprise as exercises to supplement what is learnt under paper MCAPD1-223.

MRSPTU