

**COURSE TITLE: PROGRAMMING CONCEPTS AND DESIGN, ANALYSIS OF ALGORITHMS****COURSE OBJECTIVES:**

- To introduce students to the programming concepts
- To introduce the classic algorithms in various computer domains, and techniques for designing efficient algorithms.
- To make the students aware of and well-trained in the use of the tools and Techniques of designing and analyzing algorithms.

**LEARNING OUTCOMES:**

The course will help:

- To prove the correctness and analyze the running time of the basic algorithms for those classic problems in various domains;
- To apply the algorithms and design techniques to solve problems
- To appreciate the impact of algorithm design in practice
- To analyze the complexities of various problems in different domains.

| Code   | Course  | Teaching Period / Week |        | Credit |      |       | Duration of Theory Exam (in Hrs.) |
|--------|---|------------------------|--------|--------|------|-------|-----------------------------------|
|        |   | L                      | Pr./Tu | Int.   | Ext. | Total |                                   |
| MCS101 | Programming Concepts and Design, Analysis of Algorithms | 4                      | -      | 2      | 2    | 4     | 2                                 |

| Module No. | Objective  | Content  | Evaluation             |
|------------|--|--|------------------------|
| 1          | To introduce students to programming concepts  | <b>Programming Concepts</b><br>Object Oriented Programming, Review of OOP - Objects and classes, inheritance, polymorphism, abstraction, Event driven programming, graphics programming, event handling, generic programming – generic classes – generic methods – generic code and virtual machine  | Assignment (Marks-05)  |
| 2          | To explain and use various types of analyses of algorithms<br><br>To study the role of available tools in solving a problem; | <b>Design strategies and Analysis of Algorithms</b><br>Role of Algorithms in Computing: Algorithms as a technology, Characteristics and building blocks of Algorithm. Getting Started: Designing algorithms, Well known Sorting algorithms (Insertion sort, Bubble Sort, Selection Sort, Shell Sort, Heap Sort). Divide-and-Conquer Technique: The maximum-subarray problem, Integer Multiplication, Strassen's algorithm for matrix multiplication, the substitution method for solving recurrences. Probabilistic Analysis and Randomized Algorithms: The hiring problem, Indicator random variables, Randomized algorithms. Analyzing algorithms, Growth of Functions: Some Useful Mathematical Functions & Notations, Asymptotic Functions & Notation. | Unit Test-1 (Marks-25) |

|          |  |  |                              |
|----------|--|--|------------------------------|
| <b>3</b> | To study and apply the dynamic programming and greedy algorithms for solving problems. | <b>Advanced Design</b><br>Dynamic Programming: Rod cutting, Elements of dynamic programming, longest common subsequence, The Problem of Making Change, Matrix Multiplication Using Dynamic Programming. Greedy Algorithms: An activity-selection problem, Elements of the greedy strategy, Huffman codes, Minimum Spanning Trees, Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm. | Oral Presentation (Marks 10) |
| <b>4</b> | To study and apply various graph search techniques.                                    | <b>Graph Algorithms</b><br>Representations of graphs, Traversing Trees, Breadth-first search, Depth-first search, Best-First Search & Minimax Principle, Topological Sort. Single-Source Shortest Paths: The Bellman-Ford algorithm, Single-source shortest paths in directed acyclic graphs   | Class Test (Marks 10)        |

**EVALUATION:**

| Evaluation  | Details   | Marks            |
|---|---|------------------|
| (* please give details of assessment in terms of Unit test/<br>Project/ quiz /or other assignments and marks allotted for it) |   |                  |
| Internal  | <ul style="list-style-type: none"> <li>• Unit test</li> <li>• Oral Test</li> <li>• Class Test</li> <li>• Assignments</li> </ul> | <b>50 Marks</b>  |
| External  | <b>Final Examination</b>  | <b>50 Marks</b>  |
| <b>Total marks</b>  |   | <b>100 Marks</b> |

**TEXT BOOKS:**

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, (2009), *Introduction to Algorithms*, Third Edition, PHI Learning Pvt. Ltd-New Delhi
2. Richard F Gilberg, Behrouz A Forouzan, (2005), *Data Structure A Pseudocode Approach with C*. Second edition, Cengage Publisher
- 3.

**REFERENCE BOOKS:**

1. Sanjoy Dasgupta, Christos H. Papadimitriou, Umesh Vazirani, (2006), *Algorithms*, McGraw-Hill Higher Education
2. Grokking Algorithms: An illustrated guide for programmers and other curious people, MEAP, Aditya Bhargava, (2010) <http://www.manning.com/bhargava>
3. Shaum's Outlines Data Structure Seymour Lipschutz TMH (2012)
4. Michael T. Goodrich, *Data Structures and Algorithms in C++*, (2015) Wiley Publications