

## FACULTY OF COMPUTER APPLICATIONS

|                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
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| Programme                                                                                                                                                            | Master of Computer Applications                                                                                                                                                                                                                                                                                                                |    |                  |    |       | Branch/Spec.                        | Computer Applications |           |       |
| Semester                                                                                                                                                             | I                                                                                                                                                                                                                                                                                                                                              |    |                  |    |       | Version                             | 1.0.0.0               |           |       |
| Effective from Academic Year                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                |    | 2026-27          |    |       | Effective for the batch Admitted in |                       | July 2026 |       |
| Subject Code                                                                                                                                                         | P11A2DAA                                                                                                                                                                                                                                                                                                                                       |    | Subject Name     |    |       | Design & Analysis of Algorithms     |                       |           |       |
| Teaching scheme                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       | Examination scheme (Marks)          |                       |           |       |
| (Per week)                                                                                                                                                           | Lecture (DT)                                                                                                                                                                                                                                                                                                                                   |    | Practical (Lab.) |    | Total |                                     | CE                    | SEE       | Total |
|                                                                                                                                                                      | L                                                                                                                                                                                                                                                                                                                                              | TU | P                | TW |       | Theory                              | 40                    | 60        | 100   |
| Credit                                                                                                                                                               | 3                                                                                                                                                                                                                                                                                                                                              | -  | 1                | -  | 4     | Practical                           | 20                    | 30        | 50    |
| Hours                                                                                                                                                                | 3                                                                                                                                                                                                                                                                                                                                              | -  | 2                | -  | 5     |                                     |                       |           |       |
| Objective:                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
| The main objective of this course is to provide conceptual as well as practical knowledge of various Algorithm Designing techniques and their impact on programming. |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
| Pre-requisites:                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
| Basic knowledge of data structure, programming and algorithm design.                                                                                                 |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
| Course Outcomes :                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                |    |                  |    |       |                                     |                       |           |       |
| Name of CO                                                                                                                                                           | Description                                                                                                                                                                                                                                                                                                                                    |    |                  |    |       |                                     |                       |           |       |
| CO1                                                                                                                                                                  | Analyze the performance of algorithms using asymptotic notations and recurrence relations, and apply the Divide-and-Conquer strategy to solve core computational problems like searching, sorting, and matrix multiplication.                                                                                                                  |    |                  |    |       |                                     |                       |           |       |
| CO2                                                                                                                                                                  | Apply and analyze the Greedy design paradigm to construct optimal solutions for combinatorial optimization problems including Job Sequencing with Deadlines, the Fractional Knapsack Problem, Minimum Spanning Trees (Kruskal’s/Prim’s), and Single-Source Shortest Paths (Dijkstra’s) while evaluating their time complexity and correctness. |    |                  |    |       |                                     |                       |           |       |
| CO3                                                                                                                                                                  | Apply and evaluate advanced optimization paradigms—including Dynamic Programming, Backtracking, and Branch and Bound—to design efficient solutions for complex computational and combinatorial problems such as All-Pair Shortest Paths, Traveling Salesperson, N-Queens, and Knapsack.                                                        |    |                  |    |       |                                     |                       |           |       |
| CO4                                                                                                                                                                  | Classify computational problems into complexity classes (P, NP hard and NP complete) and apply approximation algorithms to design near-optimal solutions for intractable problems like Vertex Cover and Subset Sum.                                                                                                                            |    |                  |    |       |                                     |                       |           |       |

|     | <b>Mapping of CO and PO</b> |     |     |     |     |     |     |     |
|-----|-----------------------------|-----|-----|-----|-----|-----|-----|-----|
| Cos | PO1                         | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 |
| CO1 | 3                           | 3   | 2   | 3   | -   | -   |     | 1   |
| CO2 | 3                           | 3   | 3   | 3   | -   | -   |     | 1   |
| CO3 | 3                           | 3   | 3   | 3   | -   | -   |     | 1   |
| CO4 | 2                           | 3   | 3   | 3   | -   | -   |     | 2   |

| Contents |                                                                                                                                                                                                                                                                                                          |     |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| Unit     | SECTION-I                                                                                                                                                                                                                                                                                                | Hrs |
| 1        | <b>Fundamentals of Algorithm Analysis:</b> Introduction of Algorithms, Analysis of algorithms: Space Complexity, Time Complexity, recurrence relation and Asymptotic Notation, Divide and conquer: General method, applications-Binary search, Quick sort, Merge sort, Strassen's matrix multiplication. | 12  |
| 2        | <b>Greedy Method:</b> Greedy method: General method, applications-Job sequencing with deadlines, knapsack problem, Minimum cost spanning trees, Single source shortest path problem.                                                                                                                     | 10  |
|          | <b>SECTION-II</b>                                                                                                                                                                                                                                                                                        |     |
| 3        | <b>Optimization and Search Strategies:</b> Dynamic programming Strategy: All pair shortest paths, Traveling salesman problems. Backtracking Strategy: 8-Queen problem, Sum of subsets, Knapsack problem. Branch and Bound Strategy: Least Cost Branch and Bound, 8-Queen Problem.                        | 12  |
| 4        | <b>Computational Complexity and Approximation Algorithms :</b> Lower boundary theory, Lower bound theory through reductions, P and NP problems. NP hard and NP complete problems, Cook's Theorem, Approximate Algorithms and their need, The vertex Cover Problem.                                       | 11  |

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| <b>Practical Content:</b>                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                      |
| List of programs specified by the subject teacher based on above mentioned topics                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                      |
| <b>Text Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                 | Fundamentals of Computer Algorithms, Ellis Horowitz, Satraj Sahni and Rajasekharan, University Press                                 |
| <b>Reference Books:</b>                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                 | Coremen, Leiserson, Rivest, Stein, "Introduction to Algorithms", 2nd edition, PHI.                                                   |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                 | Michael T. Goodrich, Roberto Tamassia "Algorithm Design and Applications" , Wiley                                                    |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                 | Aho, Hopcroft and Ullman, "The Design and Analysis of Computer Algorithms", Pearson                                                  |
| <b>Web References / MOOC / Certification Course</b>                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                      |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.skills.google/paths/36">https://www.skills.google/paths/36</a> (Google Cloud Computing Foundations Certificate) |
| 2                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://www.coursera.org/learn/gcp-fundamentals">https://www.coursera.org/learn/gcp-fundamentals</a>                        |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                 | <a href="https://nptel.ac.in/courses/106104182">https://nptel.ac.in/courses/106104182</a>                                            |
| <b>Question Paper Scheme:</b>                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                      |
| <b>University Examination Duration: 3 Hours</b><br><b>Note for Examiner:</b> <ol style="list-style-type: none"> <li>(1) Questions 1 and 4 are compulsory with no options.</li> <li>(2) Internal options should be given in questions 2, 3, 5 and 6.</li> </ol> <b>Paper Structure:</b><br><b>SECTION-I</b><br>Q-1 8 Marks<br>Q-2 11 Marks<br>Q-3 11 Marks<br><br><b>SECTION-II</b><br>Q-4 8 Marks<br>Q-5 11 Marks<br>Q-6 11 Marks |                                                                                                                                      |