COURSE MODULES OF THE SUBJECT FOR THE SESSION 2025-26

(EVEN SEMESTER)

Faculty Name/s : Dr. Nasreen Fathima							**Academic Year: 2025- 2026**
Department: Computer Science & Design							
Course Code	**Course Title**	**Core/Elective**	**Prerequisite**	**Contact Hours**			**Total Hrs/ Sessions**
				L	**T**	**P**	
BCS401	Analysis and Design of Algorithms	Core	Basics of Programming	3	0	0	40

Course Learning Objectives: This course (BCS401) will enable students to:

- To learn the methods for analyzing algorithms and evaluating their performance.
- To demonstrate the efficiency of algorithms using asymptotic notations.
- To solve problems using various algorithm design methods, including brute force, greedy, divide and conquer, decrease and conquer, transform and conquer, dynamic programming, backtracking, and branch and bound.
- To learn the concepts of P and NP complexity classes.

Module 1	**Contact Hours**
INTRODUCTION: What is an Algorithm?, Fundamentals of Algorithmic Problem Solving. **FUNDAMENTALS OF THE ANALYSIS OF ALGORITHM EFFICIENCY:** Analysis Framework, Asymptotic Notations and Basic Efficiency Classes, Mathematical Analysis of Non recursive Algorithms, Mathematical Analysis of Recursive Algorithms. **BRUTE FORCE APPROACHES:** Selection Sort and Bubble Sort, Sequential Search and Brute Force String Matching.	8
Module 2	
BRUTE FORCE APPROACHES (contd..): Exhaustive Search (Travelling Salesman problem and Knapsack Problem). **DECREASE-AND-CONQUER:** Insertion Sort, Topological Sorting. **DIVIDE AND CONQUER:** Merge Sort, Quick Sort, Binary Tree Traversals, Multiplication of Large Integers and Strassen's Matrix Multiplication.	8
Module 3	
TRANSFORM-AND-CONQUER: Balanced Search Trees, Heaps and Heapsort. **SPACE-TIME TRADEOFFS:** Sorting by Counting: Comparison counting sort, Input Enhancement in String Matching: Horspool's Algorithm.	8
Module 4	
DYNAMIC PROGRAMMING: Three basic examples, The Knapsack Problem and Memory Functions, Warshall's and Floyd's Algorithms. **THE GREEDY METHOD:** Prim's Algorithm, Kruskal's Algorithm, Dijkstra's Algorithm, Huffman Trees and Codes.	8

Module 5	
LIMITATIONS OF ALGORITHMIC POWER: Decision Trees, P, NP, and NP-Complete Problems. **COPING WITH LIMITATIONS OF ALGORITHMIC POWER:** Backtracking (n-Queens problem, Subset-sum problem), Branch-and-Bound (Knapsack problem), Approximation algorithms for NP-Hard problems (Knapsack problem).	08

Course Outcomes: The student will be able to :

1. Apply asymptotic notational method to analyze the performance of the algorithms in terms of time complexity.
2. Demonstrate divide & conquer approaches and decrease & conquer approaches to solve computational problems.
3. Make use of transform & conquer and dynamic programming design approaches to solve the given real world or complex computational problems.
4. Apply greedy and input enhancement methods to solve graph & string based computational problems.
5. Analyse various classes (P,NP and NP Complete) of problems
6. Illustrate backtracking, branch & bound and approximation methods.

Assessment Details (both CIE and SEE)

The weight age of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester-End Examination:

Theory SEE will be conducted by the University as per the scheduled timetable, with common question papers for the course (duration 03 hours).

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks

Textbooks:
Introduction to the Design and Analysis of Algorithms, Anany Levitin:, 3rd Edition, 2017. Pearson
Reference Books:
1. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities Press. 2. Introduction to Algorithms, Thomas H. Cormen, Charles E. Leiserson, Ronal L. Rivest, Clifford Stein, 3rd Edition, PHI. 3. Design and Analysis of Algorithms, S. Sridhar, Oxford (Higher Education)
Web links and Video Lectures (e-Resources):
Design and Analysis of Algorithms: https://nptel.ac.in/courses/106/101/106101060/

Subject : BCS401- Analysis and Design of Algorithms																	
		Program Outcomes												**Program Specific Outcomes**			
	RBT	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**Total**	**PSO1**	**PSO2**	**Total**
CO1	**L3**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
CO2	**L3**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
CO3	**L4**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
CO4	**L4**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
CO5	**L4**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
CO6	**L3**	3	3	2	-	-	-	-	-	-	-	-	2	**10**	-	-	-
Total		**18**	**18**	**12**									12	**60**			-