K. S. INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU, Approved by AICTE

Department of Computer Science & Engineering

M.Tech FIRST SEMESTER SYLLABUS

Course: Data Structures & Algorithms for Problem Solving		Semester	I
Course Code	**25MCS103**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	50	Total Marks	100
Credits	03	Exam Hours	03
Examination type (SEE)	**Theory**		

Course Objectives (Course Skill Set)

1. To reduce development time and the resources required to maintain existing applications.
2. To increase code reuse and provide a competitive advantage through effective use of data structures and algorithms.

Module-1

Search Trees: Two Models of Search Trees. General Properties and Transformations. Height of a Search Tree. Basic Find, Insert, and Delete. Returning from Leaf to Root. Dealing with Non unique Keys. Queries for the Keys in an Interval. Building Optimal Search Trees. Converting Trees into Lists. Removing a Tree. BalancedSearch Trees: Height-Balanced Trees. Weight-Balanced Trees. (a, b)- And B-Trees. Red-Black Trees and Trees of Almost Optimal Height. Top-Down Rebalancing for Red-Black Trees.

Module-2

Tree Structures for Sets of Intervals. Interval Trees. Segment Trees. Trees for the Union of Intervals. Trees for Sums of Weighted Interval. Trees for Interval-Restricted Maximum Sum Queries. Orthogonal Range Trees. Higher-Dimensional Segment Trees. Other Systems of Building Blocks. Range-Counting and the Semigroup Model. Kd-Trees and Related Structures.

Module-3

Heaps: Balanced Search Trees as Heaps. Array-Based Heaps. Heap-Ordered Trees and Half Ordered Trees. Leftist Heaps. Skew Heaps. Binomial Heaps. Changing Keys in Heaps. Fibonacci Heaps. Heaps of Optimal Complexity. Double-Ended Heap Structures and Multidimensional Heaps. Heap-Related Structures with Constant-Time Updates.

Module-4

Graph Algorithms: Bellman - Ford Algorithm; Single source shortest paths in a DAG; Johnson's Algorithm for sparse graphs; Flow networks and Ford-Fulkerson method; Maximum bipartite matching. Polynomials and the FFT: Representation of polynomials; The DFT and FFT; Efficient implementation of FFT.

Module-5

String-Matching Algorithms: Naïve string Matching; Rabin - Karp algorithm; String matching with finite automata; Knuth-Morris-Pratt algorithm; Boyer – Moore algorithms.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **25 Marks**
2. Two assignments each of **25 Marks** or **one Skill Development Activity of 25 marks** to attain the COs and POs The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks.**

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper consists of Part A and Part B. Part A consists of 10 questions from 5 modules, each carrying 2 marks.
3. Part B consists of 10 questions. Each full question is for 16 marks. There will be two full questions (with a maximum of three sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module.

Suggested Learning Resources:

Text Books:

1. Advanced Data Structures, Peter Brass, Cambridge University Press, 2008.
2. T. H Cormen, C E Leiserson, R L Rivest and C Stein. Introduction to Algorithms. PHI, 3rd Edition, 2010

Reference Books:

1. Data Structures and Algorithm Analysis in C++, Mark Allen Weiss, 4 th Edition, 2014, Pearson.
2. Data structures with Java, Ford and Topp, Pearson Education.
3. Ellis Horowitz, SartajSahni, S.Rajasekharan. Fundamentals of Computer Algorithms. Universities press. 2nd Edition, 2007
4. Data structures and Algorithms in Java, M.T.Goodrich, R.Tomassia, 3rd edition, Wiley India Edition.

Web links and Video Lectures (e-Resources):

https://www.coursera.org/learn/advanced-data-structures
https://nptel.ac.in/courses/106106133
https://pages.cs.wisc.edu/~shuchi/courses/787-F07/about.html
https://www.youtube.com/watch?v=0JUN9aDxVmI&list=PL2SOU6wwxB0uP4rJgf5ayhHWgw7akUWSf

Course outcome (Course Skill Set)

Sl. No.	Description	Blooms Level
CO1	Analyze and apply fundamental data structures and algorithms to solve complex computational problems effectively	L4
CO2	Evaluate and implement various searching, sorting to optimize algorithm performance.	L5
CO3	Design and analyze advanced tree and graph algorithms, including balanced search trees and graph traversal methods, to address real-world applications	L5

Sl. No.	Description	POs
1	Demonstrate the ability to independently conduct research and development work to address practical engineering problems.	PO1
2	Develop and deliver comprehensive technical presentations that effectively convey complex information to diverse audiences.	PO2
3	Exhibit mastery in the specialized study area, surpassing the requirements of a relevant bachelor's program.	PO3
4	Analyze engineering problems critically and apply appropriate technique, skills, and modern tools to develop innovative solutions.	PO4
5	Collaborate effectively in teams while also functioning independently, recognizing opportunities for career advancement and research.	PO5
6	Cultivate a proactive approach to continuous learning and professional development in response to evolving technological landscapes.	PO6

Program Outcome of this course

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**x**			**x**		
CO2			**x**		**x**	
CO3		**x**				
CO4					x	