MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

COURSE PLAN

Department	:	Computer Science and Engineering
Course Name & code	:	Advanced Data Structures and Algorithms & CSE 5113
Semester & branch	:	i & M.TECH CSE & CSIS
Name of the faculty	:	**MR. GURURAJ**

No of contact hours/week:

L	T	P	C
3	1	0	4

Course Outcomes (COs)

	At the end of this course, the student should be able to:	No. of Contact Hours	Marks
CO1:	Make use of sequence of different types of data structure operations and their cost finding techniques	6	13
CO2:	Demonstrate various advanced data structures such as B-tree, Binomial heaps, Fibonacci heaps	22	46
CO3:	Utilize disjoint sets and van Emde Roas Tree	12	25
CO4:	Discover shortest paths for all pairs of vertices and from single source to all other vertices.	4	8
CO5:	Understand the concept of maximum flow networks and to design and analyze Multi-Threading algorithms	4	8
	Total	48	100

Assessment Plan

Components	Assignments	Sessional Tests	End Semester/ Make-up Examination
Duration	20 to 30 minutes	60 minutes	180 minutes
Weightage	20 % (4 X 5 marks)	30 % (2 X 15 Marks)	50 % (1 X 50 Marks)
Typology of Questions	Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation	Knowledge/ Recall; Understanding/ Comprehension; Application	Understanding/ Comprehension; Application; Analysis; Synthesis; Evaluation
Pattern	Answer one randomly selected question from the problem sheet (Students can refer their class notes)	MCQ: 10 questions (0.5 marks) Short Answers: 5 questions (2 marks)	Answer all 5 full questions of 10 marks each. Each question may have 2 to 3 parts of 3/4/5/6/7 marks
Schedule	4, 7, 10, and 13th week of academic calendar	Calendared activity	Calendared activity
Topics Covered	Quiz 1 (L 1-9 & T 1-2) **(CO1)**	Test 1 (L 1-20 & T 1-6) **(CO1&2)**	Comprehensive examination covering full syllabus. Students are expected to answer all questions **(CO1-5)**
	Quiz 2 (L **10-17** & T 3-5) **(CO2 &3)**		
	Quiz 3 (L 18-27 & T 6-9) **(CO3&4)**	Test 2 (L 21-33 & T 7-10) **(CO3&4)**	
	Quiz 4 (L 28-35 & T 10-11) **(CO5)**		

Lesson Plan

L. No.	Topics	Course Outcome Addressed
L0	Introduction	CO1
L1	Amortized Analysis , Aggregate analysis	CO1
L2	Problems on Aggregate analysis	CO1
L3	The accounting method	CO1
T1	Tutorial on Amortized Analyss	CO1
L4	The potential method, Problems on potential method,	CO1
L5	Dynamic Tables, Definition of B-Trees, The Height of B-tree	CO1
L6	Basic operations on B-Trees: Searching a B-tree, Analysis, Creating an empty B-tree	CO2
T2	Tutorial on B-tree Construction	CO2
L7	Splitting a node in a B-tree	CO2
L8	Inserting a key into a B-tree and its Analysis.	CO2

L9	Deleting a key from a B-Tree,	CO2
T3	Tutorial on deletion of a key from B-Trees	CO2
L10	Properties of Binomial trees,	CO2
L11	Representation of Binomial heaps, Operations on Binomial Trees: Finding the minimum Key, Uniting the Binomial heaps	CO2
L12	Inserting a node into Binomial heap, Extracting the node with minimum key, Decrease a key, Deleting a key in Binomial heap.	CO2
T4	Tutorial on Binomial Trees	CO2
L13	Structure of Fibonacci heaps, potential function	CO2
L14	Merge able heap operations: Inserting a node, Finding the minimum node	CO2
L15	Extracting the minimum node and its Analysis, Decreasing a key in Fibonacci Heap and its cost involved	CO2
T5	Tutorial on Fibonaccii heap construction, extraction of a node and decrease key	CO2
L16	Deleting a node in Fibonacci Heap and its cost involved	CO2
L17	The van Emde Roas Tree	CO2
L18	Preliminary approaches, Recursive structure	CO2
T6	Tutorial on van Emde Roas Tree	CO2
L19	Disjoint-set operations	CO2
L20	Linked-list representation of disjoint sets	CO2
L21	Disjoint set forests.	CO2
T7	Tutorial on Disjoint set forests.	CO2
L22	Optimal substructure of shortest path , Negative weight edges, Relaxation method	CO3
L23	The Bellman-Ford algorithm, Analysis and Problems on Bellman-Ford algorithm	CO3
L24	Topological sorting, Algorithm on directed acyclic graphs and its analysis	CO3
T8	Tutorial on directed acyclic graphs	CO3
L25	Difference constraints	CO3
L26	The structure of a shortest path	CO3
L27	A recursive solution to the all-pairs shortest-paths problem, Computing the shortest-path weights bottom up	CO3
T9	Tutorial on shortrst path	CO3
L28	Matrix multiplication	CO3
L29	Algorithm Faster-All-Pairs-Shortest-Paths	CO3
L30	Problems on Slow and Faster-All-Pairs-Shortest-Paths and its analysis.	CO3

T10	Tutorial o all pairs shortest path	CO3
L31	Johnson's algorithm for sparse graphs , The Floyd-Warshall algorithm , Problems on Floyd-Warshall algorithm	CO3
L32	Flow Networks	CO4
L33	The Ford-Fulkerson method	CO4
T11	Tutorial on Flow of networks	CO4
L34	Maximum bipartite matching ,Problems on Maximum Bipartite Matching	CO4
L35	The basics of dynamic multithreading	CO5
L36	Multithreaded matrix multiplication, Multithreaded merge sort	CO5
T12	Tutorial on Multithreaded matrix multiplication	CO5
L/T	Click or tap here to enter text.	

References:

1.	Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, "Introduction to Algorithms" (3e), MIT Press, 2009
2.	Cormen Thomas H., Leiserson Charles E, Rivest Ronald L. and Stein Clifford, "Introduction to Algorithms" (2e), Prentice-Hall India, 2001
3.	Lawrence C. Washington, "Elliptic curves: number theory and cryptography", Chapman & Hall/ CRC Second Edition, 2008
4.	Baase Sara and Gelder A.V., "Computer Algorithms -Introduction to Design and Analysis", (3e), Pearson Education, 2000
5.	Anany Levitin, "Introduction to the Design and Analysis of Algorithms ", (3e), Pearson Education, 2011.
6.	Aaron M. Tenenbaum,Yedidyah Langsam,Moshe J. Augeustein, "Data Structures using C", Pearson Education, 1998
7.	Click or tap here to enter text.

Submitted by: **MR. GURURAJ**

(Signature of the faculty)

Date: **07-09-2023**

Approved by: **DR. KRISHNAMOORTHI MAKKITHAYA**

(Signature of HOD)

Date: **07-08-2023**

FACULTY MEMBERS TEACHING THE COURSE (IF MULTIPLE SECTIONS EXIST):

FACULTY	SECTION	FACULTY	SECTION
Mr Gururaj	MTech-CSE		
Mr. Prakash K Aithal	M.Tech-CSIS		

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