BMS COLLEGE OF ENGINEERING, BENGALURU-19

Department of CSE

Autonomous Institute, Affiliated to VTU

PROPOSED COURSE PLAN

Academic Year	September- December 2020	**Sem**	5th	**Section(s)**	A, B, C
Faculty Name:	Namratha M				
Course Title:	**Advanced Data Structures**				
Course Code:	**20CS5PEADS**				
L-T-P:	2-0-1	**Total Credits:**	03		

A **Course Outcomes**

At the end of the course the student will be able to

CO1	Ability to **analyze** the usage of appropriate data structure for a given application.
CO2	Ability to **design** an efficient algorithm for performing operations on various advanced data structures.
CO3	Ability to **apply** the knowledge of hashing techniques.
CO4	Ability to **conduct** practical experiments to solve problems using an appropriate data structure.

B **CO-PO-PSO mapping**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		1													
CO2			3												3
CO3	2														
CO4				3											

Indicate strength of mapping (1/2/3) with justification

C **Proposed Assessment Plan (for 50 marks of CIE)**

Tool	Remarks	Marks
Internals	**Best 2 out of 3**	**20**
Quiz-1, Quiz-2 (5 Marks Each)	**--**	**--**
Lab Component	**2 lab test (15 marks each) + Continuous evaluation (10 marks)**	**25**
Self-Study Component	**--**	**--**
AAT	**ONE**	**05**
Total		**50**

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D **Proposed Lecture Plan**

Unit #	Lecture#	Topics Covered	Remark
UNIT 1	1	**Disjoint Sets** Basic Data Structure, Smart Union algorithms	
	2	Path Compression, Time complexity for Union-by-Rank and Time complexity for Path compression, Applications.	
	3	**Advanced Lists** Generic Linked List, Memory efficient doubly linked list	
	4	XOR Linked List, Skip List	
	5	Self Organizing List, Unrolled Linked List.	
UNIT 2	6	**Trees** AVL Trees-Construction, Insertion, Rotation, Deletion operations	
	7	Splay Trees, 2-3 Trees-Construction	
	8	2-3 Trees Insertion and Deletion operations	
	9	B-Trees- Construction, Insertion and Deletion operations	
	10	Red-Black Trees- Construction, Insertion and Deletion operations.	
	11	Applications of Red-Black Trees	
UNIT 3	12	**Trees and Advanced Lists** Trie, Suffix Array Tree	
	13	Segment Tree	
	14	Splay Goat Tree	
	15	K-Dimensional Tree	
	16	Binary Indexed Tree or Fenwick Tree	
UNIT 4	17	**Hashing** Collision Resolution Techniques: Hash Tables without Linked Lists	
	18	Quadratic probing, Double hashing	
	19	Rehashing	
	20	Extendible Hashing. Applications of Hashing.	
UNIT-5	21	**Heaps** Binomial trees and Binomial heaps	
	22	Operations on binomial heaps	
	23	Operations on binomial heaps continued	
	24	Structure of Fibonacci Heaps	

	25	Mergeable heap operations	
	26	Decreasing a key and deleting a node.	

Prescribed Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1	Introduction to Algorithms	T. H Cormen, C. E. Leiserson and R. L. Rivest	2nd Edition	Prentice Hall India	2001
2	Data Structures and algorithm analysis in C++	Marks Allen Wesis	3rd Edition	Pearson Education	2014

Reference Text Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year
1.	Fundamentals of Computer Algorithms	Ellis Horowitz, Satraj Sahni and Rajasekharam	2nd Edition	University Press Pvt. Ltd,	2009

E-Book

Sl. No.	Book Title	Authors	Edition	Publisher	Year	URL
1.	Data structures and Algorithm Analysis in C++	Allen Weiss	Fourth edition	Pearson education	2014	http://iips.icci.edu.iq/images/exam/DataStructuresAndAlgorithmAnalysisInCpp_2014.pdf
2.	Introduction to Algorithms	T. H Cormen, C. E. Leiserson and R. L. Rivest	2nd Edition	Prentice Hall India	2001	https://edutechlearners.com/download/Introduction_to_algorithms-3rd%20Edition.pdf

MOOC Course

Sl. No.	Course name	Course Offered By	Year	URL
1.	Advanced Data Structures in Java	Coursera	2019	https://www.coursera.org/learn/advanced-data-structures
2.	Data Structures and Algorithms	NPTEL	2009	https://nptel.ac.in/courses/106/102/106102064/
3.	Programming and Data Structures	NPTEL	2009	https://nptel.ac.in/courses/106105085/

E **Proposed Tutorial Plan** *(if applicable)*

F **Proposed Laboratory Plan** *(if applicable)*

Note: The faculty handling the course (of all sections) should discuss and prepare four open-ended question (applications based on the topics covered in the theory class for each unit).
The continuous evaluation for the lab is done as follows:

☐ 10 marks for each lab program and 10 marks for open-ended questions.

☐ Final continuous evaluation marks will be calculated for 10 marks: (10 marks lab programs + 10 marks open-ended)/2

Lab Test-1: 15 marks for test-1 + 10 marks: Average of first 5 lab programs + 2 application implementation of the open ended question set

Lab Test-2: 15 marks for test-2 + 10 marks:
Average of last 5 programs + 2 application implementation of the open ended question set.

Sl.No	Program	Unit
1	Write a program to implement the following list: An ordinary Doubly Linked List requires space for two address fields to store the addresses of previous and next nodes. A memory efficient version of Doubly Linked List can be created using only one space for address field with every node. This memory efficient Doubly Linked List is called XOR Linked List or Memory Efficient as the list uses bitwise XOR operation to save space for one address. In the XOR linked list, instead of storing actual memory addresses, every node stores the XOR of addresses of previous and next nodes.	**UNIT 1**
2	Write a program to perform insertion, deletion and searching operations on a skip list.	**UNIT 1**
3	Given a boolean 2D matrix, find the number of islands. A group of connected 1s forms an island. For example, the below matrix contains 5 islands {1, 1, 0, 0, 0}, {0, 1, 0, 0, 1}, {1, 0, 0, 1, 1}, {0, 0, 0, 0, 0}, {1, 0, 1, 0, 1} A cell in the 2D matrix can be connected to 8 neighbours. Use disjoint sets to implement the above scenario.	**UNIT 1**
4	Write a program to perform insertion and deletion operations on AVL trees.	**UNIT 2**
5	Write a program to perform insertion and deletion operations on 2-3 trees.	**UNIT 2**
6	Write a program to implement insertion operation on a red black tree. During insertion, appropriately show how recolouring or rotation operation is used.	**UNIT 2**
7	Write a program to implement insertion operation on a B-tree.	**UNIT 2**
8	Write a program to to implement functions of Dictionary using Hashing.	**UNIT 3**
9	Write a program to implement the following functions on a Binomial heap: 1. **insert(H, k):** Inserts a key 'k' to Binomial Heap 'H'. This operation	**UNIT 5**

		first creates a Binomial Heap with single key 'k', then calls union on H and the new Binomial heap. 2. **getMin(H):** A simple way to getMin() is to traverse the list of root of Binomial Trees and return the minimum key. **3.** **extractMin(H):** This operation also uses union(). We first call getMin() to find the minimum key Binomial Tree, then we remove the node and create a new Binomial Heap by connecting all subtrees of the removed minimum node. Finally we call union() on H and the newly created Binomial Heap.	
	10	Write a program to implement the following functions on a Binomial heap: 1. **delete(H):** Like Binary Heap, delete operation first reduces the key to minus infinite, then calls extractMin(). 2. **decreaseKey(H):** decreaseKey() is also similar to Binary Heap. We compare the decreases key with it parent and if parent's key is more, we swap keys and recur for parent. We stop when we either reach a node whose parent has smaller key or we hit the root node.	**UNIT 5**

G	**Proposed Self-Study Plan** *(if applicable)*

H	**Proposed Alternate Assessment Tool Plan** *(if applicable)*
	Plan: Platform: HackerRank 4 questions (coding related) will be designed on HackerRank (1-EASY LEVEL, 2-MEDIUM LEVEL, 1-DIFFICULT LEVEL) will be framed and students are supposed to code within 2 hours of time. Average of all 4 questions will be considered for awarding the marks. Students are supposed to come to the CSE lab and do the coding in front of batch-in-charges only.
I	**List the suggestions/Comments for improvement of the course (or similar course) delivered during the previous Academic year** *(as mentioned in the Course File)*

J	**Proposed Action Plan to address the suggestions/Comments**

K	**CO Attainment during the previous Academic Year**

This course has been introduced as an Elective course

CO#	Attainment: CAYm1 (Jan-May 2019)	Remarks
CO1		
CO2		
CO3		
CO4		

L	**Proposed innovations in TLP/Best Practices (delivery/assessment)**
	Placement related questions to be discussed in class. Coding assignments to be given to students.
M	**Any other**

Signature(s) of the Faculty(s) Signature of the HOD

Date:

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i) The Course plan is an attempt to ensure **continuous improvement** in the TLP of the course.
ii) The proposed Course Plan is submitted to **DAC** before the commencement of the semester.
iii) At the end of the semester, the faculty shall submit the **actual implemented plan**.
iv) Calendar of Events included.

CALENDAR OF EVENTSFOR THE ACADEMICYEAR 2020-21

BACHELOR OF ENGINEERING PROGRAMMES – HIGHER SEMESTERS

SEM	S.No	EVENT	DATES
ODDSEMESTER *	1	Course Registration	14.09.2020
	2	Commencement of Classes	15.09.2020
	3	DROPPINGOF COURSES	On or before14.10.2020
	4	CIE:Quiz#1/AAT#1	On or before 20.10.2020
	5	CIE:TEST#1	21.10.2020to 23.10.2020
	6	CIE:Quiz#2/AAT#2	On or before 27.11.2020
	7	CIE:TEST#2	30.11.2020, 01.12.2020 & 02.12.2020
	8	WITHDRAWALOF COURSES	On or before**15.12.2020**
	9	CIE:TEST#3	21.12.2020to 23.12.2020
	10	LASTWORKINGDAY	31.12.2020
	11	**SEE: Semester End Examination****	**04.01.2021 to 18.01.2021**
	12	Vacation for Students	19.01.2021 to 31.01.2021
EVENSEMESTER	13	Course Registration	01.02.2021
	14	Commencement of Classes	02.02.2021
	15	DROPPINGOF COURSES	On orbefore15.02.2021
	16	CIE:Quiz#1/AAT#1	On or before 05.03.2021
	17	CIE:Test#1	08.03.2021to 10.03.2021
	18	CIE:Quiz#2/AAT#2	On orbefore12.04.2021
	19	CIE:Test#2	15.04.2021to 17.04.2021
	20	WITHDRAWALOF COURSES	On or before**10.05.2021**
	21	CIE:Test#3	20.05.2021 to 22.05.2021
	22	LASTWORKINGDAY	26.05.2021
	23	**SEE: Semester End Examination****	**1.06.2021to 15.06.2021**
	24	Vacation for Students	16.06.2021to31.07.2021
	25	**Supplementary Semester**	**June-July 2021**

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** The Odd Semester will be conducted in online / offline blended mode*

*** Semester End Examination dates may change due to unavoidable circumstances.*