K.S. SCHOOL OF ENGINEERING AND MANAGEMENT, BENGALURU - 560109

DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

CO-PO Mapping

Course: Data Structures and Applications				
Type: Professional Core Course			Course Code: BCS304	
No of Hours				
Theory (Lecture Class)	Tutorials	Practical/Field Work/Allied Activities	Total/Week	Total hours of Pedagogy
3	0	0	3	40
Marks				
CIE	SEE		Total	Credits
50	50		100	3

Aim/Objectives of the Course

1. To explain fundamentals of data structures and their applications
2. To illustrate representation of data structures: Stack, Queues, Linked Lists, Trees and Graphs.
3. To design and develop solutions to problems using linear Data Structures.
4. To discuss applications of Nonlinear Data Structures in problem solving
5. To introduce advanced Data structure concepts such as Hashing and Optimal Binary Search Trees.

Course Learning Outcomes

After completing the course, the students will be able to

CO1	**Apply** the basic data structures concepts such as arrays, structures, unions, pointers, strings and dynamic memory allocation function to solve simple problems. **Make use of** stacks to evaluate mathematical expression.	**Applying (K3)**
CO2	**Apply** the concept of queues and linked list in problem solving.	**Applying (K3)**
CO3	**Utilize** linked list for implementation of list operations, doubly linked list and sparse matrix, and **apply** tree traversal method, threaded binary tree.	**Applying (K3)**
CO4	**Make use of** binary search tree, selection trees and forests and graph to solve real world problems.	**Applying (K3)**
CO5	**Analyze** advanced Data Structures concepts such as Hashing Techniques and OptimalBinary Search Trees.	**Applying (K3)**

Syllabus Content

MODULE 1 : INTRODUCTION TO DATA STRUCTURES: Data Structures, Classifications (Primitive & Non-Primitive), Data structure Operations **Review of** pointers and dynamic Memory Allocation, **ARRAYS and STRUCTURES:** Arrays, Dynamic Allocated Arrays, Structures and Unions, Polynomials, Sparse Matrices, representation of Multidimensional Arrays, Strings.	CO1 8 hrs PO1-1 PO2-3 PO3-3 PO4-3 PO6-1

STACKS: Stacks, Stacks Using Dynamic Arrays, Evaluation and conversion of Expressions. **LO:** At the end of this session the student will be able to 1. Understand the basic data structures concepts. 2. Analyze the stack operations, dynamic memory allocation and Structures. 3. Understand the sparse matrix and evaluation and conversion of expressions.	PO12 -1 PSO1-3 PSO2-1
MODULE 2 : QUEUES: Queues, Circular Queues, Using Dynamic Arrays, Multiple Stacks and queues. **LINKED LISTS :** Singly Linked, Lists and Chains, Representing Chains in C, Linked Stacks and Queues, Polynomials **LO:** At the end of this session the student will be able to 1. Analyze Queue operations using dynamic arrays. 2. Understand the concepts of linked list and chains. 3. Solve simple problems on linked list such as polynomials.	**CO2** 8 hrs. PO1-1 PO2-3 PO3-3 PO4-3 PO6-1 PO12-1 PSO1-3 PSO2-1
MODULE 3: LINKED LISTS : Additional List Operations, Sparse Matrices, Doubly Linked List. **TREES:** Introduction, Binary Trees, Binary Tree Traversals, Threaded Binary Trees. **LO:** At the end of this session the student will be able to 1. Understand the concepts of doubly linked list and Trees terminologies. 2. Solve binary tree traversals. 3. Solve simple problems on linked list such as sparse matrix.	**CO3** 8 hrs PO1-1 PO2-3 PO3-3 PO4-3 PO6-1 PO12-1 PSO1-3 PSO2-1
MODULE 4: TREES(Cont..): Binary Search trees, Selection Trees, Forests, Representation of Disjointsets, Counting Binary Trees, **GRAPHS:** The Graph Abstract Data Types, Elementary Graph Operations **LO:** At the end of this session the student will be able to 1. Understand the Binary Search trees, Forests and counting Binary trees. 2. Understand the graph terminologies. 3. Analyze elementary Graph operations	**CO4** 8 hrs PO1-1 PO2-3 PO3-3 PO4-3 PO6-1 PO12-1 PSO1-3 PSO2-1
MODULE 5: HASHING: Introduction, Static Hashing, Dynamic Hashing **PRIORITY QUEUES:** Single and double ended Priority Queues, Leftist Trees **INTRODUCTION TO EFFICIENT BINARY SEARCH TREES:** Optimal Binary Search Trees. **LO:** At the end of this session the student will be able to 1. Understand hashing technique. 2. Analyze Single and double ended priority queues, leftist trees.	**CO5** 8hrs PO1-1 PO2-3 PO3-3 PO4-3 PO6-1 PO12-1

3. Understand Optimal Binary search Trees.	PSO1-3 PSO2-1

Text Books

1. Ellis Horowitz and Sartaj Sahni, **Fundamentals of Data Structures in C**, 2nd Ed, Universities Press, 2014.

Reference Books (specify minimum two foreign authors text books)

1. Seymour Lipschutz, **Data Structures Schaum's Outlines**, Revised 1st Ed, McGraw Hill, 2014.
2. Gilberg & Forouzan, Data Structures: **A Pseudo-code approach with C**, 2nd Ed, Cengage Learning,2014.
3. Reema Thareja**, Data Structures using C**, 3rd Ed, Oxford press, 2012.
4. Jean-Paul Tremblay & Paul G. Sorenson, **An Introduction to Data Structures with Applications**, 2nd Ed, McGraw Hill, 2013
5. A M Tenenbaum, **Data Structures using C**, PHI, 1989
6. Robert Kruse, **Data Structures and Program Design in C**, 2nd Ed, PHI, 1996.

Useful Websites

- http://elearning.vtu.ac.in/econtent/courses/video/CSE/06CS35.html
- https://nptel.ac.in/courses/106/105/106105171/
- http://www.nptelvideos.in/2012/11/data-structures-and-algorithms.html
- https://www.youtube.com/watch?v=3Xo6P_V-qns&t=201s
- https://ds2-iiith.vlabs.ac.in/exp/selection-sort/index.html
- https://nptel.ac.in/courses/106/102/106102064/
- https://ds1-iiith.vlabs.ac.in/exp/stacks-queues/index.html
- https://ds1-iiith.vlabs.ac.in/exp/linked-list/basics/overview.html
- https://ds1-iiith.vlabs.ac.in/List%20of%20experiments.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/index.html
- https://ds1-iiith.vlabs.ac.in/exp/tree-traversal/depth-first-traversal/dft-practice.html
- https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013501595428077568125 59/overview

Teaching and Learning Methods

1. Lecture class: 40 hrs

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 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. Marks scored shall be proportionally reduced to 50 marks.

CO to PO Mapping

PO1: Science and engineering Knowledge **PO2:** Problem Analysis **PO3:** Design & Development **PO4:**Investigations of Complex Problems **PO5:** Modern Tool Usage **PO6:** Engineer & Society	**PO7:**Environment and Society **PO8:**Ethics **PO9:**Individual & Team Work **PO10:** Communication **PO11:**Project Mgmt. & Finance **PO12:** Lifelong Learning

PSO1: An ability to design and develop Artificial Intelligence technology into innovative products for solving real world problems.

PSO2: An ability to design and develop Data Science methods for analyzing massive datasets to extract insights by applying AI as a tool.

CO	PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CS304	K-level														
01	K3	1	3	3	3	-	1	-	-	-	-	-	1	3	1
02	K3	1	3	3	3	-	1	-	-	-	-	-	1	3	1
03	K3	1	3	3	3	-	1	-	-	-	-	-	1	3	1
04	K3	1	3	3	3	-	1	-	-	-	-	-	1	3	1
C	K3	1	3	3	3	-	1	-	-	-	-	-	1	2	1

Course In charge

HOD

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