SIR PADAMPAT SINGHANIA UNIVERSITY

UDAIPUR

July 2021

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Udaipur

COURSE PLAN of **CS-2201** **Data Structures**

Name of the Course Teacher(s) : Poonam Saini

Course Coordinator : Poonam Saini

Branch: CSE/CTIS Semester: III Year: 2nd

Course Code: CS-2201 L-T-P-S-C: 3-0-0-X-3 w.e.f. July 2021

Contact Hours : 3

Moodle Page Link: http://poonamsainispsu.gnomio.com

Prerequisite: Structured Programming Approach

Program Specific Outcomes (PSO's)

- PSO1: The ability to understand, analyse and develop computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient design of computer-based systems of varying complexity.
- PSO2: The ability to understand the evolutionary changes in computing, apply standard practices and strategies in software project development using open-ended programming environments to deliver a quality product for business success, real world problems and meet the challenges of the future

Course Objectives:

- To introduce the fundamental concepts of data structures and to emphasize the importance of data structures in developing and implementing efficient algorithms.
- To strengthen the abilities of the students to identify and apply suitable data structures for solving real world problems.
- To impart the knowledge of various sorting and searching techniques.

Course Outcomes:

After successful completion of this course, the students will be able to

- CO1: **Understand** different categories of data Structures, **identify** different parameters to analyze the performance of an algorithm and to choose appropriate data structures to solve real world problems efficiently.
- CO2: **Apply** algorithms to perform operations on Linear data structures
- CO3: **Apply** algorithms to perform operations on Non-linear data Structures
- CO4: **Illustrate** various technique for searching & Sorting

Course Outcomes (Weightage): (SUM TOTAL OF ALL WEIGHTAGES 100%)

Course Outcomes	CO1	CO2	CO3	CO4	Total
Weightage %	10	35	35	20	100

Mapping of COs to POs

S. No.	Subject Name	Subject Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	Database Management System	CS-3003	2	2	2	2	1	-	-	-	-	-	-	1	1	1

CO/PO Mapping **(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak**															
COs	**Programme Outcomes (POs)**														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	Weightage % *
CO1	2	2	2	2	-	-	-	-	-	-	-	1	1	1	10
CO2	2	2	2	2	1	-	-	-	-	-	-	1	1	1	35
CO3	2	2	2	2	1	-	-	-	-	-	-	1	1	1	35
CO4	2	2	2	2	1	-	-	-	-	-	-	1	1	1	20

Andragogic Plan including sequencing of lectures

L1= Remember, L2= Understand, L3=Apply, L4= Analyze, L5=Evaluate, L6= Create

Sr. No.	Topics (smallest unit for which Blooms Taxonomy has been used)	LEVEL	Andragogy	No. of Sessions	CO (Weightage) SUM OF WEIGHTAGES FOR EACH CO TO BE 100%
Module-01					
1	Introduction: data, structure, data structure, need of data structure, characteristics of data structure, ADT	L2	Class room	1	1(CO1)
2	Overview of Linear Data Structures	L1	Class room	1	1.5(CO1)
3	Overview of Non-Linear Data Structures, Operations on Data Structures	L1	Class room	1	1.5(CO1)
4	Application areas of different data structures, Refinement stages to solve a complex problem	L3, L2, L1	Flipped Class	1	2(CO1)
5	Algorithm characteristics, Approaches for designing an algorithm	L2	Class room	1	1(CO1)
6	Analysis of Algorithm, Time & Space Complexity	L2	Class room	1	2(CO1)
7	Big O Notation, Types of Analysis	L2	Class room	1	1(CO1)
8	Arrays: Linear Representation of an Array, 2-D Arrays: Row Major and Column Maor Order	L2	Flipped Class	1	1(CO2)
9	Algorithm of Array traversal, insertion, deletion	L3	Class room + Lab Activity	1	2(CO2)
Module-02					
10	Introduction to linked list, drawbacks of an array, representation of linked list in memory, algorithm of traversing a linked list	L2, L3	Class room + Lab Activity	1	2(CO2)
11	Algorithm to Insert into a sorted linked list, Example of Insertion	L3	Class room + Lab Activity	1	1(CO2)
12	Algorithms to 1. delete a node after a given node. 2 delete the node with a given item of information. Example of deletion.	L3	Class room + Lab Activity	1	4(CO2)
13	Introduction to header linked list, its types, properties. Algorithm for 1. Traversing a circular linked list 2. Searching a circular linked list 3. Deletion in circular linked	L3	Class room + Lab Activity	1	3(CO2)

	list , Introduction to two way lists and two way header list				
14	Operations on two way lists. Algorithm for 1. Traversing 2. searching 3. deletion 4. insertion on a two list. Concept of structure within structure, typedef	L3	Class room + Lab Activity	1	3(CO2)
Module-03					
15	Introduction to stacks, array representation of stacks: algorithm to push and pop an element from a stack with example, Linked list representation of stacks: algorithm to push and pop the element in a linked stack	L2, L3	Class room + Lab Activity	1	3(CO2)
16	Applications of Stacks: Reversing a list, Polish notation and its types, Algorithm for converting infix to postfix expression with example, Algorithm for evaluating postfix expression with example, Example of recursion.	L3	Class room + Lab Activity	1	4(CO2)
17	Introduction to queues, representation of a queue as an array, procedure to insert and delete the item from a queue, Linked representation of a queue, comparison of array representation of a queue with linked list	L2, L3	Class room + Lab Activity	1	4(CO2)
18	Algorithm for operations on linked queue: Insertion, deletion. Deques, types of deques, example of deque as a circular array, Example of deque as a linked list	L3	Class room + Lab Activity	1	4(CO2)
19	Introduction to priority queues, One way list representation of a Priority Queue, Algorithms to delete and insert the elements from the priority queues, Array representation of a priority queue and its example, Application of queues: simulation	L2,L3	Class room + Lab Activity	1	4(CO2)
Module-04					
20	Introduction to trees, Binary trees, its terminology, complete binary tree, extended binary tree or 2-tree, Linked representation of a binary tree and its example.	L2,L3	Class room	1	2(CO3)

21	Sequential representation of a binary tree and its example. Traversing binary trees: Preorder, inorder, postorder. Examples.	L2,L3	Class room	1	2(CO3)
22	Preorder Traversal algorithm using stacks and example	L3	Class room	1	1(CO3)
23	Inorder Traversal algorithm using stacks and example	L3	Class room	1	1(CO3)
24	Postorder Traversal algorithm using stacks and example	L3	Class room	1	1(CO3)
25	Binary Search Trees, Searching and Inserting in BST algorithm, Appilcation of BST	L2,L3	Class room + Flipped Class	1	2(CO3)
26	Deletion algorithm of BST with different cases, example of deletion in BST	L3	Class room	1	2(CO3)
27	Introduction to AVL search trees, Insertion algorithm, LL Rotation, RR rotation with example	L2	Class room + Flipped Class	1	1(CO3)
28	LR and RL rotations with examples, Deletion in an AVL search tree, R0, R1, R-1, L0, L1, L-1 rotations with examples	L2	Class room + Flipped Class	1	1(CO3)
29	Introduction to m-way search tree, Searching and insertion in m-way search tree with example	L2,L3	Class room	1	2(CO3)
30	Deletion in an m-way search tree with example	L2,L3	Class room	1	1(CO3)
31	Introduction to B-Trees, Searching, Insertion and Deletion algorithms, examples	L2,L3	Class room+Lab Activity	1	3(CO3)
32	Introduction to heap, insertion, deletion and heapsort algorithms, example of heap	L2,L3	Class room + Flipped Class	1	3(CO3)
33	Example of Binary Search Tree, AVL search tree, Heap	L3	Flipped Class	1	3(CO3)
Module-05					
34	Introduction to Graphs, Types with example	L2	Class room	1	2(CO3)
35	Linked representation of a graph, Operations on graph: searching	L2,L3	Class room + Flipped Class	1	2(CO3)
36	Algorithms to insert a node and edge into a graph with examples	L3	Class room+Lab Activity	1	1.5(CO3)
37	Algorithms to delete a node and edge from a graph with examples	L3	Class room+Lab Activity	1	1.5(CO3)

38	Algorithms for Breadth-First and Depth-First searches with examples	L3	Class room+Lab Activity	1	3(CO3)
Module-06					
39	Algorithms of Linear Search, Binary Search	L3	Lab Activity	1	5(CO4)
40	Algorithms of Bubble sort, Insertion sort, with examples	L3	Class room + Lab Activity	1	5(CO4)
41	Algorithm of Selection sort, Quick Sort with examples	L3	Class room + Lab Activity	1	5(CO4)
42	Algorithms of Merge sort and Radix sort with examples	L3	Class room + Lab Activity	1	5(CO4)

Text Books:

1. Data Structure Using C. Balagurusamy, Tata McGraw-Hill.
2. Data Structures, Adapted by: Pai G. Schaum"s Outlines.
3. Data Structures Using C. Tenenbaum A. M., Langsam Y. & Augenstein M. J., Pearson.

Reference Books:

1. Data Structures Using C. ISRD Group, 2nd Ed. Tata McGraw-Hill.
2. Data Structures using C. Thareja R., Oxford.
3. Data Structures using C and C++. Shukla R. K., Wiley – India.
4. Data Structures: A Pseudocode Approach with C. Gilberg R. F. & Forouzan, 2nd Ed. CENGAGE Learning.
5. Introduction to Data Structure and Its Applications. Tremblay J. P. & Sorenson P. G.
6. C & Data Structures. Deshpande P. S. & Kakde O. G., DreamTech press.

Video Link:

1 https://nptel.ac.in/courses/106/102/106102064/
2 https://www.youtube.com/watch?v=RBSGKlAvoiM

Other study material:

1. Hand Written Notes
2. PowerPoint Slides

University Evaluation Scheme

Sr. No.	Assessment	Weightage (%)	Modification in Weightage (%) By Teacher
1.	Mid Term Examination – I and II	35 (17.5 % Each)	30
2.	Quiz (Best 2 out of 3)	15 (5 % Each)	10
3.	S & GD/Active Learning & Class Assignment	10	20
4.	Assignment	5	5
5.	Attendance	5	5
6.	End Term Examination	30	30

Course Evaluation Scheme with Attainment Measurement

Sr. No.	Topics (smallest unit for which Blooms Taxonomy has been used)	LEVEL	EVALUATION METHOD and Marks Bifurcation										Relevant CO(%)			
			FORMATIVE					SUMMATIVE								
			A	D	T	P		Q	T	P	O	MT	ET				
														1	2	3	4
1	Sr. 15-18(Class Assignment - 01)	L3	10												5		
2	Sr. 21-24(Class Assignment - 02)	L3	10													5	
3	Sr. No. 38-42 (Home Assignment)	L3	10														10
4	Sr. No. 17 & 19(Discussion)	L3		5											5		
5	Sr. No. 32 & 33 (Discussion)	L3		5												5	
6	Sr. 1-7(Q-01)	L1						10						2			
7	Sr.8-14 (Q-02)	L1						10						1	5		
8	Sr. 34-37(Q-03)	L1						10								5	
9	Sr. 1-14(MT-1)	L1, L2 & L3										25		3	5		
10	Sr. 15-28(MT-2)	L1, L2 & L3										25			5	7	

11	Sr. 1- 42(ET)	L1, L2 & L3										50	4	10	13	10
			30	10				20				50	50	10	35	35	20
			25%					75%									

Distribution of EVALUATIONS including schedules

FORMATIVE (Total weightage)

1. Class **A**ssignments (weightage/marks)/ Case Study/Discussions periodicity (continuous/end of term)
   (a) Assignment(10%)- Two Class Assignments: ACO2(5%), ACO3(5%)
   (b) Discussion(10%)- DCO2(5%), DCO3(5%)
2. Assignment (weightage)
   Home Assignment-ACO4(5%)

SUMMATIVE (Total weightage)

1. Quizzes

   Best 2 out of 3(10%)

   Q1(Sr. 1-7)- QCO1
   Q2(Sr. 8-14)-QCO2
   Q3(Sr. 34-37)-QCO3
2. CLASS TESTS
   MT-1(Sr. 1-14)(15%)- CO-01, CO-02
   MT-2(Sr. 15-28)(15%)-CO-02, CO-03

3. END TERM EXAM
   Sr. 1-42(30%)

Expected Average Attainment of the Class:

Average Attainment of CO1

Course Outcomes	CO1				
Assessment	Formative		Summative		
	Tool	Avg. %	Tool	Avg. %	ET
1					
2					
3					

Average Attainment of CO2

Course Outcomes	CO2	
Assessment	Formative	Summative

	Tool	Avg. %	Tool	Avg. %	ET
1					
2					
3					

Course Outcome	CO1	CO2	CO3	--	CO_i	Total Avg. Outcome
Average Attainment						

Total Average Attainment

$$W = \frac{\sum_{i=1}^{n} w_i \, CO_i}{\sum_{i=1}^{n} w_i}$$

Course Plan Submission

- Faculty member has to fill the course plan (except Average Attainment) before the start of semester and submit a copy to Head of Department and Dean SOE for the Approval.
- On the completion of semester evaluation, course plan has to submit with the Total average outcomes to the Head of Department and Dean SOE.
- Feedback from the subject Teacher.

Name of Subject Teacher Head of Department

Dean