LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Ms. K. VINAYA SREE BAI
Course Name & Code : Data Structures (20CS03)
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech II Sem AI & DS - A **A.Y.:** 2022-23

PREREQUISITE: Programming for Problem Solving using C.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to learn the constructs of the Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. In the process of learning the language, they will be applying knowledge of object oriented programming; they will get the fundamental knowledge reason collection framework.

CO1	Write the algorithms for various operations on list using arrays and linked list and analyze the time complexity of its operations. **(Understand - L2)**
CO2	Apply linear data structures like stack and queue in problem solving. **(Apply - L3)**
CO3	Demonstrate various searching and sorting techniques and compare their computational complexities in terms of space and time. **(Understand - L2)**
CO4	Write the algorithms for various operations on binary trees, binary search trees and AVL trees. **(Understand - L2)**
CO5	Demonstrate graph traversal techniques and hashing techniques. **(Understand - L2)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-

1 - Low **2 –**Medium **3 -** High

TEXTBOOKS:

T1 **Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd edition [1,2,3 units].**
T2 **ReemaThareja, Data Structures using c, Oxford Publications [3,4,5].**

REFERENCE BOOKS:

R1 **Langson, Augenstein &Tenenbaum, 'Data Structures using C and C++', 2nd Ed, PHI.**
R2 **RobertL.Kruse, Leung and Tando, 'Data Structures and Program Design in C', 2ndedition, PHI.**

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DS:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Data Structures	1	13-3-23		TLM1	
2.	Introduction to Data Structures	1	14-3-23		TLM1	
3.	Classification of Data Structures	1	16-3-23		TLM1	
4.	Classification of Data Structures	1	17-3-23		TLM1	
5.	Introduction to Algorithm	1	20-3-23		TLM1	
6.	Algorithm Analysis	1	21-3-23		TLM1	
7.	Asymptotic Notations	1	23-3-23		TLM1	
8.	Introduction to Arrays	1	24-3-23		TLM1	
9.	List using Arrays	1	27-3-23		TLM1	
10.	List using Linked List	1	28-3-23		TLM1	
11.	Single Linked List	1	31-3-23		TLM1	
12.	Double Linked List	1	3-4-23		TLM1	
13.	Circular Linked List	1	4-4-23		TLM1	
14.	Assignment-1	1	6-4-23		TLM1	
No. of classes required to complete UNIT-I: 14				No. of classes taken:		

UNIT-II: Stacks & Queues:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction to Stack: Stack ADT	1	6-4-23 & 10-4-23		TLM1	
16.	Stacks using arrays	1	11-4-23		TLM1	
17.	Stacks using Linked List	1	13-4-23		TLM1	
18.	Applications of Stacks	1	17-4-23		TLM1	
19.	Infix to postfix conversion	2	18-4-23		TLM1	
20.	Evaluation of Postfix	1	20-4-23		TLM1	
21.	Checking the balanced symbols	1	21-4-23		TLM1	
22.	Queue	1	24-4-23		TLM1	
23.	Queue using array	1	25-4-23		TLM1	
24.	Queue using linked list	1	27-4-23		TLM1	
25.	Circular queue	2	28-4-23		TLM1	
26.	Deque	1	1-5-23		TLM1	
27.	Assignment-2	1	2-5-23		TLM1	
No. of classes required to complete UNIT-II: 15				No. of classes taken:		

UNIT-III: Sorting Techniques

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Introduction to Sorting: Bubble sort	1	2-5-23 & 4-5-23		TLM1	
29.	Insertion Sort	1	4-5-23		TLM1	
30.	Selection Sort	1	5-5-23		TLM1	
31.	Merge Sort	1	15-5-23		TLM1	
32.	Merge Sort	1	16-5-23		TLM1	
33.	Quick Sort	1	18-5-23		TLM1	
34.	Heap Sort	1	19-5-23		TLM1	
35.	Assignment-3	1	22-5-23		TLM1	
No. of classes required to complete UNIT-III: 8				No. of classes taken:		

UNIT-IV: Introduction to Tress

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Introduction to Trees:	1	23-5-23		TLM1	
37.	Tree Traversals	1	25-5-23		TLM1	
38.	Tree Traversals	1	26-5-23		TLM1	
39.	Binary Trees	1	29-5-23		TLM1	
40.	Binary Search Trees	1	30-5-23		TLM1	
41.	Binary Search Trees	1	1-6-23		TLM1	
42.	AVL Trees	1	2-6-23		TLM1	
43.	Operations	1	5-6-23		TLM1	
44.	Assignment-4	1	6-6-23		TLM1	
No. of classes required to complete UNIT-IV: 9				No. of classes taken:		

UNIT-V: Graphs & Hashing:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	Graphs, fundamentals	1	8-6-23		TLM1	
46.	Representation of graphs	1	9-6-23		TLM1	
47.	Graph Traversal: BFS	1	12-6-23		TLM1	
48.	Graph Traversal: DFS	2	13-6-23		TLM1	
49.	Hashing Introduction	1	15-6-23		TLM1	
50.	Hash Table, Hash Function	1	16-6-23		TLM1	
51.	Collision Resolution Techniques: Separate Chaining	1	19-6-23		TLM1	
52.	Linear Probing	1	20-6-23		TLM1	
53.	Quadratic Probing	1	22-6-23 & 23-6-23		TLM1	
54.	Double Hashing	1	26-6-23 & 27-6-23		TLM1	
55.	Rehashing	1	30-6-23		TLM1	
56.	Assignment-5	1	3-7-23			
No. of classes required to complete UNIT-V: 12				No. of classes taken:		

Content Beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
56.	Introduction to Advanced Data Structures	1	4-7-23 & 6-7-23		TLM1	
57.	Advanced Lists	1	7-7-23		TLM1	

Teaching Learning Methods			
TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Ms. K. Vinaya Sree Bai**	**Dr. S. Nagarjuna Reddy**	**Dr. Y. Vijaya Bhaskar**	**Dr. O. Rama Devi**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Ms. K. VINAYA SREE BAI
Course Name & Code : Data Structures (20CS03)
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech II Sem AI & DS - B **A.Y.:** 2022-23

PREREQUISITE: Programming for Problem Solving using C.

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to learn the constructs of the Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. In the process of learning the language, they will be applying knowledge of object-oriented programming; they will get the fundamental knowledge reason collection framework.

Course Outcomes:

CO1	Write the algorithms for various operations on list using arrays and linked list and analyze the time complexity of its operations. **(Understand - L2)**
CO2	Apply linear data structures like stack and queue in problem solving. **(Apply - L3)**
CO3	Demonstrate various searching and sorting techniques and compare their computational complexities in terms of space and time. **(Understand - L2)**
CO4	Write the algorithms for various operations on binary trees, binary search trees and AVL trees. **(Understand - L2)**
CO5	Demonstrate graph traversal techniques and hashing techniques. **(Understand - L2)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO2	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	-
CO4	3	1	-	-	-	-	-	-	-	-	-	-	3	-	-
CO5	3	1	-	-	-	-	-	-	-	-	-	-	2	-	-
1 - Low						**2** –Medium						**3** - High			

TEXTBOOKS:

T1 **Mark Allen Weiss, "Data Structures and Algorithm Analysis in C", Pearson Education, 2nd edition [1,2,3 units].**
T2 **ReemaThareja, Data Structures using c, Oxford Publications [3,4,5].**

REFERENCE BOOKS:

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R2 **RobertL.Kruse, Leung and Tando, 'Data Structures and Program Design in C', 2ndedition, PHI.**

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to DS:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Data Structures	1	14-3-23		TLM1	
2.	Introduction to Data Structures	1	15-3-23		TLM1	
3.	Classification of Data Structures	1	17-3-23		TLM1	
4.	Classification of Data Structures	1	18-3-23		TLM1	
5.	Introduction to Algorithm	1	21-3-23		TLM1	
6.	Algorithm Analysis	1	24-3-23		TLM1	
7.	Asymptotic Notations	1	25-3-23		TLM1	
8.	Introduction to Arrays	1	28-3-23		TLM1	
9.	List using Arrays	1	29-3-23		TLM1	
10.	List using Linked List	1	31-3-23		TLM1	
11.	Single Linked List	1	4-4-23		TLM1	
12.	Double Linked List	1	8-4-23		TLM1	
13.	Circsular Linked List	1	11-4-23		TLM1	
14.	Assignment-1	1	12-4-23		TLM1	
No. of classes required to complete UNIT-I: 14				No. of classes taken:		

UNIT-II: Stacks & Queues:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction to Stack: Stack ADT	1	15-4-23		TLM1	
16.	Stacks using arrays	1	18-4-23		TLM1	
17.	Stacks using Linked List	1	19-4-23		TLM1	
18.	Applications of Stacks	1	19-4-23		TLM1	
19.	Infix to postfix conversion	2	21-4-23		TLM1	
20.	Evaluation of Postfix	1	21-4-23		TLM1	
21.	Checking the balanced symbols	1	25-4-23		TLM1	
22.	Queue	1	26-4-23		TLM1	
23.	Queue using array	1	26-4-23		TLM1	
24.	Queue using linked list	1	28-4-23		TLM1	
25.	Circular queue	2	29-4-23		TLM1	
26.	Deque	1	2-5-23		TLM1	
27.	Assignment-2	1	3-5-23		TLM1	
No. of classes required to complete UNIT-II: 15				No. of classes taken:		

UNIT-III: Sorting Techniques

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Introduction to Sorting: Bubble sort	1	3-5-23		TLM1	
29.	Insertion Sort	1	5-5-23		TLM1	
30.	Selection Sort	1	6-5-23		TLM1	
31.	Merge Sort	1	16-5-23		TLM1	
32.	Merge Sort	1	17-5-23		TLM1	
33.	Quick Sort	1	19-5-23		TLM1	
34.	Heap Sort	1	20-5-23		TLM1	
35.	Assignment-3	1	23-5-23		TLM1	

No. of classes required to complete UNIT-III: 8	No. of classes taken:

UNIT-IV: Introduction to Tress

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Introduction to Trees:	1	24-5-23		TLM1	
37.	Tree Traversals	1	26-5-23		TLM1	
38.	Tree Traversals	1	27-5-23		TLM1	
39.	Binary Trees	1	30-5-23		TLM1	
40.	Binary Search Trees	1	31-5-23		TLM1	
41.	Binary Search Trees	1	2-6-23		TLM1	
42.	AVL Trees	1	3-6-23		TLM1	
43.	Operations	1	6-6-23		TLM1	
44.	Assignment-4	1	7-6-23		TLM1	
No. of classes required to complete UNIT-IV: 9				No. of classes taken:		

UNIT-V: Graphs & Hashing:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	Graphs, fundamentals	1	9-6-23		TLM1	
46.	Representation of graphs	1	10-6-23		TLM1	
47.	Graph Traversal: BFS	1	13-6-23		TLM1	
48.	Graph Traversal: DFS	2	14-6-23		TLM1	
49.	Hashing Introduction	1	16-6-23		TLM1	
50.	Hash Table, Hash Function	1	17-6-23		TLM1	
51.	Collision Resolution Techniques: Separate Chaining	1	20-6-23		TLM1	
52.	Linear Probing	1	21-6-23		TLM1	
53.	Quadratic Probing	1	23-6-23 & 24-6-23		TLM1	
54.	Double Hashing	1	27-6-23 & 28-6-23		TLM1	
55.	Rehashing / Assignment-5	1	30-6-23 & 1-7-23		TLM1	
No. of classes required to complete UNIT-V: 12				No. of classes taken:		

Content beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
56.	Introduction to Advanced Data Structures	1	4-7-23 & 5-7-23		TLM1	
57.	Advanced Lists	1	7-7-23 & 8-7-23		TLM1	

Teaching Learning Methods			
TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCS)

TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	**Marks**
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to
PO 11	**Project management and finance:** Demonstrate knowledge and understanding of the

	engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning:** Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Ms. K. Vinaya Sree Bai**	**Dr. S. Nagarjuna Reddy**	**Dr. Y. Vijaya Bhaskar**	**Dr. O. Rama Devi**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor : Ms. K. VINAYA SREE BAI
Course Name & Code **:** Data Structures Lab (20CS53)
L-T-P Structure **:** 0-0-3 **Credits:** 1.5
Program/Sem/Sec : B.Tech II Sem AI & DS - A **A.Y.:** 2022-23

PRE-REQUISITE: Programming for Problem Solving using C and Data structures

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to apply the constructs of Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. They will be applying knowledge of object-oriented programming, collection framework to perform all operations on data.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Implement Linear Data Structures using array and Linked list. **(Apply - L3)**
CO 2	Implement Various Sorting Techniques. **(Apply - L3)**
CO 3	Implement Non-Linear Data Structure such as Trees &Graphs. **(Apply - L3)**
CO 4	Improve individual / teamwork skills, communication & report writing skills with ethical values.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Discuss of CO's & CEO's	3	16-3-23		TLM4	
2	List using Arrays, Linked List Programs	3	23-3-23		TLM4	
3	Stack Using Arrays, Linked List	3	6-4-23		TLM4	
4	Queue Using arrays, Linked List	3	13-4-23		TLM4	
5	Infix to Prefix, Infix to Postfix	3	20-4-23		TLM4	
6	Evolution of Postfix Balanced Parenthesis	3	27-4-23		TLM4	
7	Circular Queue, Double Ended Queue	3	4-5-23		TLM4	
8	Bubble sort, Selection sort, Insertion sort	3	11-5-23		TLM4	
9	Merge sort, Quick sort	3	18-5-23		TLM4	
10	Heap sort, Binary Tree	3	25-5-23		TLM4	
11	Binary Search Tree	3	1-6-23		TLM4	
12	BFS, DFS	3	8-6-23		TLM4	
13	DFS, Practice on all modules	3	15-6-23 & 22-6-23		TLM4	
14	Internal Exam	3	6-7-23		TLM4	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R20 Regulations):

According to Academic Regulations of R20 Distribution and Weightage of Marks For Laboratory Courses is as follows

Continuous Internal Evaluation (CIE):

The Continuous Internal Evaluation (CIE) is based on the following parameters:

Parameter	Marks
Day to Day work	5
Record	5
Internal Test	5
Total	**15**

Semester End Examinations (SEE):

The Semester End examinations (SEE) for laboratory courses shall be jointly conducted by internal and external examiners with 3 hours duration and evaluated for 35 marks. The performance of the student shall be evaluated as per the parameters indicated below:

Parameter	Marks
Procedure/Algorithm	5
Experimentation/Program execution	10
Observations/Calculations/Validation	10
Result/Inference	5
Viva voce	5
Total	**35**

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Ms. K. Vinaya Sree Bai**	**Dr. S. Nagarjuna Reddy**	**Dr. Y. Vijaya Bhaskar**	**Dr. O. Rama Devi**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor: Ms. K. VINAYA SREE BAI
Course Name & Code : Data Structures Lab (20CS53)
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : B.Tech II Sem AI & DS - B **A.Y.:** 2022-23

PRE-REQUISITE: Programming for Problem Solving using C and Data structures

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to apply the constructs of Java programming language along with built-in facilities to create different applications such as console & graphical user interfaces. They will be applying knowledge of object-oriented programming, collection framework to perform all operations on data.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Implement Linear Data Structures using array and Linked list. **(Apply - L3)**
CO 2	Implement Various Sorting Techniques. **(Apply - L3)**
CO 3	Implement Non-Linear Data Structure such as Trees &Graphs. **(Apply - L3)**
CO 4	Improve individual / teamwork skills, communication & report writing skills with ethical values.

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

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

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2** – Moderate (Medium), **3 -** Substantial (High).

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Discuss of CO's & CEO's	3	15-3-23		TLM4	
2	List using Arrays, Linked List Programs	3	29-3-23		TLM4	
3	Stack Using Arrays, Linked List	3	12-4-23		TLM4	
4	Queue Using arrays, Linked List	3	19-4-23		TLM4	
5	Infix to Prefix, Infix to Postfix	3	26-4-23		TLM4	
6	Evolution of Postfix Balanced Paranthesis	3	3-5-23		TLM4	
7	Circular Queue, Double Ended Queue	3	17-5-23		TLM4	
8	Bubble sort, Selection sort, Insertion sort	3	24-5-23		TLM4	
9	Merge sort, Quick sort	3	31-5-23		TLM4	
10	Heap sort, Binary Tree	3	7-6-23		TLM4	
11	Binary Search Tree	3	14-6-23		TLM4	
12	BFS, DFS	3	21-6-23		TLM4	
13	DFS, Practice on all modules	3	28-6-23		TLM4	
14	Internal Exam	3	5-7-23		TLM4	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

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Continuous Internal Evaluation (CIE):

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Total	**15**

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Parameter	Marks
Procedure/Algorithm	5
Experimentation/Program execution	10
Observations/Calculations/Validation	10
Result/Inference	5
Viva voce	5
Total	**35**

PART-D

PROGRAMME OUTCOMES (POs):

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PROGRAMME SPECIFIC OUTCOMES (PSOs):

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Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Ms. K. Vinaya Sree Bai**	**Dr. S. Nagarjuna Reddy**	**Dr. Y. Vijaya Bhaskar**	**Dr. O. Rama Devi**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs. V Sowjanya
Course Name & Code : Discrete Mathematical Structures (20CS04)
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech II Sem AI & DS A-SEC **A.Y.:** 2022-23

PRE-REQUISITE : **Basic Mathematical Knowledge.**

COURSE OBJECTIVE: In this Course student will learn about- The objective of the course is to perform the operations associated with relations and functions. Relate practical examples to the functions and relations and interpret the associated operations and terminology used in the context. Use formal logic proofs and/or informal but rigorous logical reasoning to, for example, predict the behavior of software or to solve problems such as puzzles.

COURSE OUTCOMES (CO):

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

CO1	Construct mathematical arguments using logical connectives & quantifiers and verify them.**(Understand – L2)**
CO2	Demonstrate the basic terminology of functions, relations, lattices, and their operations.**(Understand – L2)**
CO3	Apply the properties of graphs to solve the graph theory problems in Computer science.**(Apply – L3)**
CO4	Illustrate the basic principles/techniques to solve different algebraic structures & combinatorial problems.**(Apply – L3)**
CO5	Solve linear recurrence relations by recognizing homogeneity using constant coefficients characteristic roots and Generating functions. **(Apply – L3)**

COURSE ARTICULATION MATRIX (Correlation between COs &POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**3**	**3**													
CO2	**3**	**3**	**1**	**2**											
CO3	**3**	**3**	**1**	**2**											
CO4	**3**	**3**	**2**	**1**											
CO5	**3**	**3**	**1**												
1 - Low							**2** –Medium					**3** – High			

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1 Tremblay, Manohar, Discrete Mathematical Structures with Applications to ComputerScience, TMH Publications[units- 1,2,3,4,5]

BOS APPROVED REFERENCE BOOKS:

R1 Chandrasekaran,Umaparvathi,DiscreteMathematics,PHI, 2010[1,2,3,4,5]

R2 Ralph. P.Grimaldi, Ramana, Discrete and Combinational Mathematics,Pearson,5th edition. [1,2,3,4,5]

R3 https://nptel.ac.in/courses/106/106/106106183/[1,2,3,4,5] .

PART-B

COURSE DELIVERY PLAN (LESSON PLAN)
UNIT-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Statements and Notations , Connectives	1	13-3-2023		2,4	CO1	T1,R1	
2.	Truth Tables, Tautologies	1	16-3-2023		2,4	CO1	T1,R1	
3.	Equivalence of Formulas	1	17-3-2023		2,4	CO1	T1,R1	
4.	Implications	1	18-3-2023		2,4	CO1	T1,R1	
5.	Tautological Implications		20-3-2023		2,4	CO1	T1,R1	
6.	Normal Forms Disjunctive Normal Form	1	23-3-2023		2,4	CO1	T1,R1	
7.	PCNF, PDNF	1	24-3-2023		2,4	CO1	T1,R1	
8.	Theory of Inference for Statement Calculus	1	25-3-2023		2,4	CO1	T1,R1	
9.	Consistency of Premises	1	27-3-2023		2,4	CO1	T1,R1	
10	Indirect Method of Proof, Predicate Logic	1	31-3-2023		2,4	CO1	T1,R1	
11	Statement Functions	1	01-4-2023		2,4	CO1	T1,R1	
12	Variables and Quantifiers.	1	03-4-2023		2,4	CO1	T1,R1	
13	**Tutorial- I**	1	06-4-2023		3			
No. of classes required to complete UNIT-I		13			No. of classes taken:			

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UNIT-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
14.	Introduction to Sets, representation of Sets.	1	08-4-2023		2,4	CO2	T1,R1	
15.	Operation on Sets	1	10-4-2023		2,4	CO2	T1,R1	
16.	Properties of Binary Relations	1	13-4-2023		2,4	CO2	T1,R1	
17.	Relation Matrix	1	15-4-2023		2,4	CO2	T1,R1	
19.	Equivalence Relation	1	17-4-2023		2,4	CO2	T1,R1	
20.	Compatibility and Partial Ordering Relations	1	20-4-2023		2,4	CO2	T1,R1	
21.	Hasse Diagrams	1	21-4-2023		2,4	CO2	T1,R1	
22.	Lattices: LUB, GLB.	1	24-4-2023		2,4	CO2	T1,R1	
23	**Functions**: Bijective Functions	1	27-4-2023		2,4	CO2	T1,R1	
24	Composition of Functions	1	28-4-2023		2,4	CO2	T1,R1	
25	Inverse Functions, **Tutorial-II**	1	29-4-2023		3			
No. of classes required to complete UNIT-II		12			No. of classes taken:			

UNIT-III

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
26.	**Graph Theory I :**Basic Concepts of Graphs	1	1-5-2023		2,4	CO3	T1,R2	
27.	Matrix Representation of Graphs: Adjacency Matrices	1	4-5-2023		2,4	CO3	T1,R2	
28.	Incidence Matrices, Isomorphic Graphs	1	5-5-2023		2,4	CO3	T1,R2	
29.	Eulerian and Hamiltonian Graphs.	1	6-5-2023		2,4	CO3	T1,R2	
30.	**Graph Theory II:** Planar Graphs, Euler's Formula	1	29-5-2023		2,4	CO3	T1,R2	
31.	Graph Coloring, Chromatic Number	1	01-06-2023		2,4	CO3	T1,R2	
32.	Graph Traversals: BFS, DFS	1	02-06-2023		2,4	CO3	T1,R2	
33.	Trees**:** Spanning Trees: Properties	1	03-06-2023		2,4	CO3	T1,R2	
34	Algorithms for Minimum cost Spanning Trees	1	05-06-2023		2,4	CO3	T1,R2	
35.	**Tutorial-III**	1	08-06-2023		3			
No. of classes required to complete UNIT-III		11			No. of classes taken:			

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UNIT-IV

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
36.	**Algebraic Structures & Combinatorics** Algebraic Systems with one Binary Operation	1	09-6-2023		1,4,5	CO4	T1,R2	
37.	Properties of Binary operations	1	10-6-2023		1,4,5	CO4	T1,R2	
38.	Semi groups and Monoids: Homomorphism of Semi groups and Monoids	1	12-6-2023		1,4,5	CO4	T1,R2	
39.	Group, Abelian group	1	15-6-2023		1,4,5	CO4	T1,R2	
40.	Sub Groups	1	16-6-2023		1,4,5	CO4	T1,R2	
41.	Lagrange's Theorem	1	17-6-2023		1,4,5	CO4	T1,R2	
42.	**Combinatorics:** Basic of Counting,	1	19-6-2023		1,4,5	CO4	T1,R2	
43.	Permutations, Combinations,	1	22-6-2023		1,4,5	CO4	T1,R2	
44.	Combinations with repetition Pigeonhole Principle	1	23-6-2023		1,4,3	CO4	T1,R2	
45.	Pigeonhole Principle and its Applications	1	24-6-2023		1,4,5	CO4	T1,R2	
46.	Principle of inclusion-exclusion.	1	26-6-2023		1,4,5	CO4	T1,R2	
47.	**Tutorial-IV**	1	30-6-2023					
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
48.	**Recurrence Relation**	1	30-6-2023		1,4,5	CO5	T1,R2	
49.	Generating Function of Sequences	1	01-07-2023		1,4,5	CO5	T1,R2	
50.	Calculating Coefficient of Generating Functions	1	03-07-2023		1,4,5	CO5	T1,R2	
51.	Recurrence Relations	1	04-07-2023		1,4,5	CO5	T1,R2	
52.	Solving linear or homogeneous recurrence Relations by substitution	1	06-07-2023		1,4,5	CO5	T1,R2	
53.	generating functions	1	07-07-2023		1,4,3	CO5	T1,R2	
54.	Characteristic Roots, **Tutorial-V**	1	08-07-2023					
No. of classes required to complete UNIT-V		7			No. of classes taken:			

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Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
55.								
56.								

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	13-3-2023	6-5-2023	7W
I Mid Examinations	8-5-2023	13-5-2023	1W
II Phase of Instructions	15-5-2023	8-7-2023	7W
II Mid Examinations	10-7-2023	15-7-2023	1W
Preparation and Practicals	17-7-2023	22-7-2023	1W
Semester End Examinations	24-7-2023	5-8-2023	2W

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics, responsibilities, and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC with 'A' Grade, ISO 9001:2015 Certified Institution

Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Mrs.V.Sowjanya			Dr.O.RamaDevi
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

PROGRAM : **B.Tech**, II-Sem

SECTION : **B**

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **Discrete Mathematical Structures – 20CS04**

L-T-P STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : V.CHANDRA KUMAR

COURSE COORDINATOR : V.CHANDRA KUMAR

PRE-REQUISITE: Basic Mathematical Knowledge.

COURSE OBJECTIVE: In this Course student will learn about- The objective of the course is to perform the operations associated with relations and functions. Relate practical examples to the functions and relations and interpret the associated operations and terminology used in the context. Use formal logic proofs and/or informal but rigorous logical reasoning to, for example, predict the behavior of software or to solve problems such as puzzles.

COURSE OUTCOMES (CO):
At the end of the course, the student will be able to:

CO1	Construct mathematical arguments using logical connectives & quantifiers and verify them.**(Understand – L2)**
CO2	Demonstrate the basic terminology of functions, relations, lattices, and their operations.**(Understand – L2)**
CO3	Apply the properties of graphs to solve the graph theory problems in Computer science.**(Apply – L3)**
CO4	Illustrate the basic principles/techniques to solve different algebraic structures & combinatorial problems.**(Apply – L3)**
CO5	Solve linear recurrence relations by recognizing homogeneity using constant coefficients characteristic roots and Generating functions. **(Apply – L3)**

COURSE ARTICULATION MATRIX (Correlation between COs&POs,PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3													
CO2	3	3	1	2											
CO3	3	3	1	2											
CO4	3	3	2	1											
CO5	3	3	1												
1 - Low							**2** –Medium						**3** – High		

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

1- Slight(Low), **2 -** Moderate(Medium), **3 -** Substantial (High).BOS APPROVED TEXT BOOKS:

T1 Tremblay, Manohar, Discrete Mathematical Structures with Applications to ComputerScience, TMH Publications[units- 1,2,3,4,5]

BOS APPROVED REFERENCE BOOKS:

R1 Chandrasekaran,Umaparvathi,DiscreteMathematics,PHI, 2010[1,2,3,4,5]

R2 Ralph. P.Grimaldi, Ramana, Discrete and Combinational Mathematics,Pearson,5th edition. [1,2,3,4,5]

R3 https://nptel.ac.in/courses/106/106/106106183/[1,2,3,4,5] .

PART-B

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Statements and Notations , Connectives	1	13-3-2023		2,4	CO1	T1,R1	
2.	Truth Tables, Tautologies	1	14-3-2023		2,4	CO1	T1,R1	
3.	Equivalence of Formulas	1	16-3-2023		2,4	CO1	T1,R1	
4.	Implications	1	20-3-2023		2,4	CO1	T1,R1	
5.	Tautological Implications		21-3-2023		2,4	CO1	T1,R1	
6.	Normal Forms Disjunctive Normal Form	1	23-3-2023		2,4	CO1	T1,R1	
7.	PCNF, PDNF	1	27-3-2023		2,4	CO1	T1,R1	
8.	Theory of Inference for Statement Calculus	1	28-3-2023		2,4	CO1	T1,R1	
9.	Consistency of Premises	1	30-3-2023		2,4	CO1	T1,R1	
10	Indirect Method of Proof, Predicate Logic	1	3-4-2023		2,4	CO1	T1,R1	
11	Statement Functions	1	4-4-2023		2,4	CO1	T1,R1	
12	Variables and Quantifiers.	1	6-4-2023		2,4	CO1	T1,R1	
13	**Tutorial- I**	1	8-4-2023		3			
No. of classes required to complete UNIT-I		13			No. of classes taken:			

UNIT-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
14.	Introduction to Sets, representation of Sets.	1	10-4-2023		2,4	CO2	T1,R1	
15.	Operation on Sets	1	11-4-2023		2,4	CO2	T1,R1	
16.	Properties of Binary Relations	1	13-4-2023		2,4	CO2	T1,R1	
17.	Relation Matrix	1	17-4-2023		2,4	CO2	T1,R1	

19.	Equivalence Relation	1	18-4-2023		2,4	CO2	T1,R1	
20.	Compatibility and Partial Ordering Relations	1	20-4-2023		2,4	CO2	T1,R1	
21.	Hasse Diagrams	1	24-4-2023		2,4	CO2	T1,R1	
22.	Lattices: LUB, GLB.	1	25-4-2023		2,4	CO2	T1,R1	
23	**Functions**: Bijective Functions	1	27-4-2023		2,4	CO2	T1,R1	
24	Composition of Functions	1	1-5-2023		2,4	CO2	T1,R1	
25	Inverse Functions, **Tutorial-II**	1	2-5-2023		3			
No. of classes required to complete UNIT-II		12			No. of classes taken:			

UNIT-III

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
26.	**Graph Theory I :**Basic Concepts of Graphs	1	4-5-2023		2,4	CO3	T1,R2	
27.	Matrix Representation of Graphs: Adjacency Matrices	1	8-5-2023		2,4	CO3	T1,R2	
28.	Incidence Matrices, Isomorphic Graphs	1	9-5-2023		2,4	CO3	T1,R2	
29.	Eulerian and Hamiltonian Graphs.	1	11-5-2023		2,4	CO3	T1,R2	
30.	**Graph Theory II:** Planar Graphs, Euler's Formula	1	15-5-2023		2,4	CO3	T1,R2	
31.	Graph Coloring, Chromatic Number	1	16-5-2023		2,4	CO3	T1,R2	
32.	Graph Traversals: BFS, DFS	1	18-5-2023		2,4	CO3	T1,R2	
33.	Trees**:** Spanning Trees: Properties	1	22-5-2023		2,4	CO3	T1,R2	
34	Algorithms for Minimum cost Spanning Trees	1	23-5-2023		2,4	CO3	T1,R2	
35.	**Tutorial-III**	1	25-5-2023		3			
No. of classes required to complete UNIT-III		11			No. of classes taken:			

UNIT-IV

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
36.	**Algebraic Structures & Combinatorics** Algebraic Systems with one Binary Operation	1	29-5-2023		1,4,5	CO4	T1,R2	
37.	Properties of Binary operations	1	30-5-2023		1,4,5	CO4	T1,R2	
38.	Semi groups and Monoids: Homomorphism of Semi groups and Monoids	1	1-6-2023		1,4,5	CO4	T1,R2	
39.	Group, Abelian group	1	5-6-2023		1,4,5	CO4	T1,R2	
40.	Sub Groups	1	6-6-2023		1,4,5	CO4	T1,R2	
41.	Lagrange's Theorem	1	8-6-2023					

42.	**Combinatorics:** Basic of Counting,	1	12-6-2023					
43.	Permutations, Combinations,	1	13-6-2023					
44.	Combinations with repetition Pigeonhole Principle	1	15-6-2023		1,4,3	CO4	T1,R2	
45.	Pigeonhole Principle and its Applications	1	19-6-2023					
46.	Principle of inclusion-exclusion.	1	20-6-2023					
47.	**Tutorial-IV**	1	22-6-2023					
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
48.	**Recurrence Relation**	1	24-6-2023		1,4,5	CO5	T1,R2	
49.	Generating Function of Sequences	1	25-6-2023		1,4,5	CO5	T1,R2	
50.	Calculating Coefficient of Generating Functions	1	27-6-2023		1,4,5	CO5	T1,R2	
51.	Recurrence Relations	1	1-7-2023		1,4,5	CO5	T1,R2	
52.	Solving linear or homogeneous recurrence Relations by substitution	1	2-7-2023		1,4,5	CO5	T1,R2	
53.	generating functions	1	4-7-2023		1,4,3	CO5	T1,R2	
54.	Characteristic Roots, **Tutorial-V**	1	8-7-2023					
No. of classes required to complete UNIT-V		7			No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
55.			9-7-2023					
56.			10-7-2023					

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	13-3-2023	6-5-2023	7W
I Mid Examinations	8-5-2023	13-5-2023	1W
II Phase of Instructions	15-5-2023	8-7-2023	7W
II Mid Examinations	10-7-2023	15-7-2023	1W
Preparation and Practicals	17-7-2023	22-7-2023	1W
Semester End Examinations	24-7-2023	5-8-2023	2W

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

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Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr.V.Chandra Kumar**	**Mr.V.Chandra Kumar**	**Dr.O.Rama Devi**	**Dr.O.Rama Devi**
Signature				