LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC with 'A' Grade,
ISO 21001:2018, 50001:2018, 14001:2015 Certified Institution
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada.
L.B.REDDY NAGAR, MYLAVARAM. NTR District, AP, India. 521230.
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. V. Chandra Kumar
Course Name & Code : Discrete Mathematics & Graph Theory & 23FE11
L-T-P Structure : **3-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech/III/B **A.Y.:** 2026-27
Regulations : R23

PREREQUISITE: Mathematics courses of first year of study.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- To introduce the students to the topics and techniques of discrete methods and combinatorial reasoning.
- To introduce a wide variety of applications. The algorithmic approach to the solution of problems is fundamental in discrete mathematics, and this approach reinforces the close ties between this discipline and the area of computer science.

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

CO1	Construct mathematical arguments using logical connectives and quantifiers and verify them. **(Apply- L3)**
CO2	Demonstrate the basic terminology of functions, relations, lattices and their operations. **(Understand -L2)**
CO3	Illustrate the basic principles/techniques to solve different combinatorial problems and linear recurrence relations**.(Apply- L3)**
CO4	Demonstrate the different types of graphs.**(Understand -L2)**
CO5	Apply the properties of graphs to solve the graph theory problems in computer science**.(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	1													
CO2	3	2	1												
CO3	3	3	1	1											
CO4	3	3	1												
CO5	3	3	1	1											1
1 - Low			**2** –Medium							**3** - High					

TEXTBOOKS:

T1 Discrete Mathematical Structures with Applications to Computer Science, J. P. Tremblay and P. Manohar, Tata McGraw Hill.

T2 Elements of Discrete Mathematics-A Computer Oriented Approach, C. L.Liu and D. P. Mohapatra, 3rd Edition, Tata McGraw Hill.

T3 Theory and Problems of Discrete Mathematics, Schaum's Outline Series, Seymour Lipschutz and Marc Lars Lipson, 3rd Edition, McGraw Hill

REFERENCE BOOKS:

R1	Discrete Mathematics for Computer Scientists and Mathematicians, J. L.Mott, A. Kandel and T. P. Baker, 2nd Edition, Prentice Hall of India.
R2	Discrete Mathematical Structures, Bernand Kolman, Robert C. Busby and Sharon Cutler Ross, PHI.
R3	Discrete Mathematics, S. K. Chakraborty and B.K. Sarkar, Oxford, 2011.
R4	Discrete Mathematics and its Applications with Combinatorics and Graph Theory, K. H. Rosen, 7th Edition, Tata McGraw Hill.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: MATHEMATICAL LOGIC

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.	Propositional Calculus: Statements and Notations, Connectives	1	13-07-2026		TLM1	
2.	Well Formed Formulas, Truth Tables	1	15-07-2026		TLM1	
3.	Tutorial on : Statements and Notations, Connectives,TruthTables	1	16-07-2026		TLM3	
4.	Tautologies, Equivalence of Formulas, Duality Law	1	18-07-2026		TLM1	
5.	Tautological Implications, Normal Forms,	1	20-07-2026		TLM1	
6.	Theory of Inference for Statement Calculus, Consistency of Premises,	1	22-07-2026		TLM1	
7.	Tutorial on : Theory of Inference for Statement Calculus, Consistency of Premises	1	23-07-2026		TLM3	
8.	Indirect Method of Proof, Predicate Calculus: Predicates	1	25-07-2026		TLM1	
9.	Predicative Logic, Statement Functions	1	27-07-2026		TLM1	
10.	Variables and Quantifiers	1	29-07-2026		TLM1	
11.	Tutorial on : Predicates, Predicative Logic, Statement Functions,	1	30-07-2026		TLM3	
12.	Free and Bound Variables	1	1-08-2026		TLM1	
13.	Inference Theory for Predicate Calculus	1	3-08-2026		TLM1	
14.	Tutorial on Unit 1	1	5-08-2026		TLM3	
No. of classes required to complete UNIT-I: 14				**No. of classes taken:**		

UNIT-II: SET THEORY

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.	Sets: Operations on Sets	1	6-08-2026		TLM1	
16.	Principle of Inclusion-Exclusion	1	10-08-2026		TLM1	
17.	Relations: Properties, Operations	1	12-08-2026		TLM1	
18.	Tutorial on Practice the sets and Relations Problems	1	13-08-2026		TLM3	
19.	Partition and Covering,	1	17-08-2026		TLM1	

20.	Transitive Closure, Equivalence,	1	19-08-2026 To 20-08-2026		TLM1	
21.	Compatibility and Partial Ordering, Hasse Diagrams	1	22-08-2026		TLM1	
22.	Tutorial on Transitive Closure, Equivalence, Hasse Diagrams	1	24-08-2026		TLM3	
23.	Functions: Bijective, Composition, Inverse,	2	27-08-2026 To 29-08-2026		TLM1	
24.	Permutation, and Recursive Functions,	1	31-08-2026		TLM1	
25.	Tutorial on Functions& Recursive Functions	1	2-09-2026		TLM3	
26.	Lattice and its Properties	1	3-09-2026		TLM1	
No. of classes required to complete UNIT-II: 13				**No. of classes taken:**		

UNIT-III: COMBINATORICS AND RECURRENCE RELATIONS:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Basis of Counting, Permutations, Permutations with Repetitions	1	10-09-2026		TLM1	
28.	Circular and Restricted Permutations, Combinations,	1	12-09-2026		TLM1	
29.	Tutorial on Permutations, Combinations,	1	16-09-2026		TLM3	
30.	Restricted Combinations	1	17-09-2026		TLM1	
31.	Binomial and Multinomial Coefficients and Theorems.	1	19-09-2026		TLM1	
32.	Tutorial on Binomial and Multinomial Coefficients and Theorems.	1	21-09-2026		TLM3	
33.	Recurrence Relations: Generating Functions, Function of Sequences,	1	23-09-2026		TLM1	
34.	Partial Fractions, Calculating Coefficient of Generating Functions	1	24-09-2026		TLM1	
35.	Recurrence Relations, Formulation as Recurrence Relations	1	26-09-2026		TLM1	
36.	Tutorial on Partial Fractions, Recurrence Relations	1	28-09-2026		TLM3	
37.	Solving Recurrence Relations by Substitution and Generating Functions	1	30-09-2026		TLM1	
38.	Method of Characteristic Roots, Solving Inhomogeneous Recurrence Relations	1	5-10-2026		TLM1	
39.	Tutorial on UNIT III	1	7-10-2026		TLM3	
No. of classes required to complete UNIT-III: 13				**No. of classes taken:**		

UNIT-IV: Graph Theory:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Basic Concepts, Graph Theory and its Applications	1	8-10-2026		TLM1	
41.	Subgraphs, Graph Representations: Adjacency and Incidence Matrices	1	10-10-2026		TLM1	
42.	Isomorphic Graphs,	1	12-10-2026		TLM1	
43.	Paths and Circuits	1	14-10-2026		TLM1	
44.	Tutorial on Graphs	1	15-10-2026		TLM3	
45.	Eulerian and Hamiltonian Graphs,	1	17-10-2026		TLM1	
No. of classes required to complete UNIT-IV: 6				**No. of classes taken:**		

UNIT-V: Multi Graphs

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
46.	Multigraphs,	1	26-10-2026		TLM1	
47.	Bipartite and Planar Graphs	1	27-10-2026		TLM1	
48.	Tutorial on Bipartite and Planar Graphs	1	28-10-2026		TLM3	
49.	Euler's Theorem	1	29-10-2026		TLM1	
50.	Graph Colouring	1	31-10-2026		TLM1	
51.	Covering	1	2-11-2026		TLM1	
52.	Tutorial on Graph Colouring, Euler Theorem	1	3-11-2026		TLM3	
53.	Chromatic Number	1	4-11-2026		TLM1	
54.	Spanning Trees, Prim's and Kruskal's Algorithms	1	5-11-2026		TLM1	
55.	BFS Spanning Trees.	1	7-11-2026		TLM1	
56.	Tutorial on UNIT V	1	9-11-2026		TLM3	
57.	DFS Spanning Trees	1	10-11-2026		TLM1	
No. of classes required to complete UNIT-V: 12				**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	HOD Sign Weekly
1.	Pigeon Hole Principle	1	27-10-2026		**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 (R23 Regulation):

Evaluation Task	**Marks**
Assignment-I (Units-I,II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (Unit-III, IV & V)	M2=15
II-Quiz Examination (Unit-III, 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 modeling 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 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	**Mr. V. Chandra Kumar**	**Mrs.B.Swathi**	**Dr.D.Srinivasarao**	**Dr. P.Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.O.Rama Devi
Course Name & Code : DATABASE MANAGEMENT SYSTEM & 23CS03
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech./AI&DS/III/B **A.Y.:** 2026-27

PREREQUISITE: Data Structures

COURSE EDUCATIONAL OBJECTIVES(CEO):

1. Introduce database management systems and to give a good formal foundation on the relational model of data and usage of Relational Algebra
2. Introduce the concepts of basic SQL as a universal Database language
3. Demonstrate the principles behind systematic database design approaches by covering conceptual design, logical design through normalization
4. Provide an overview of physical design of a database system, by discussing Database indexing techniques and storage techniques

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

CO1	Understand the foundation of database management system and various data models. **(Understand-L2)**
CO2	Identify relational model concepts, implement various constraints, and perform SQL queries and DML operations. **(Understand-L2)**
CO3	Apply SQL queries, functions, and work with nested queries, grouping, joins, views, and set operations. **(Apply-L3)**
CO4	Apply various normalization techniques for efficient data handling. **(Apply-L3)**
CO5	Understand transaction management, recovery & indexing 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	2	-	-	-	-	-	-	-	-	2	-	-	3
CO2	3	2	2	-	-	-	-	-	-	-	-	2	-	-	3
CO3	3	2	2	-	-	-	-	-	-	-	-	2	-	-	3
CO4	3	2	2	-	-	-	-	-	-	-	-	2	-	-	3
CO5	3	2	2	-	-	-	-	-	-	-	-	2	-	-	3
1 - Low				**2** –Medium								**3** - High			

TEXTBOOKS:

T1 Database Management Systems,3rd edition, Raghurama Krishnan, Johannes Gehrke, TMH (For Chapters 2, 3, 4)

T2 Database System Concepts,5th edition, Silberschatz, Korth, Sudarsan, TMH (For Chapter 1 and Chapter 5)

REFERENCE BOOKS:

R1 Introduction to Database Systems,8th edition, CJ Date, Pearson.

R2 Database Management System,6th edition, Ramez Elmasri, Shamkant B. Navathe, Pearson

R3 Database Principles Fundamentals of Design Implementation and Management, Corlos Coronel, Steven Morris, Peter Robb, Cengage Learning

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction: Database System

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 and Discussion of CO's	1	13-07-2026		TLM1	
2.	Introduction: Database system	1	14-07-2026		TLM2	
3.	Characteristics (Database Vs File System) & Database Users	1	16-07-2026		TLM2	
4.	Advantages of Database systems & Database applications	1	17-07-2026		TLM2	
5.	Brief introduction of different Data models	1	20-07-2026		TLM2	
6.	Concepts of Schema, Instance and data independence	2	21-07-2026 23-07-2026		TLM2	
7.	Three tier schema architecture for data independence	2	24-07-2026 27-07-2026		TLM2	
8.	Database system structure & environment	2	28-07-2026 30-07-2026		TLM2	
9.	Centralized and Client Server architecture for the database.	2	31-07-2026 03-08-2026		TLM2	
10.	Tutorial	1	04-08-2026		TLM3	
No. of classes required to complete UNIT-I: 14				**No. of classes taken:**		

UNIT-II: Entity Relationship Model

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Representation of entities & attributes	1	06-08-2026		TLM2	
12.	Entity set, Relationship & Relationship set.	2	07-08-2026 10-08-2026		TLM1	
13.	constraints, sub classes, super class & inheritance	2	11-08-2026 13-08-2026		TLM1	
14.	Specialization & generalization using ER Diagrams.	2	14-08-2026 17-08-2026		TLM2	
15.	Introduction to relational model	2	18-08-2026 20-08-2026		TLM1	
16.	concepts of domain, attribute, tuple & relation.	2	21-08-2026 24-08-2026		TLM1	
17.	Importance of null values & constraints (Domain, Key constraints, integrity constraints)	2	25-08-2026 27-08-2026		TLM1	
18.	Relational Algebra	2	28-08-2026 31-08-2026		TLM1	
19.	Relational Calculus	1	01-09-2026		TLM1	

20.	Tutorial	1	03-09-2026		TLM3	
No. of classes required to complete UNIT-II: 17				**No. of classes taken:**		

UNIT-III: SQL: BASIC SQL:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Simple Database schema & Data types	1	10-09-2026		TLM2	
22.	Table definitions (create, alter), different DML operations (insert, delete, update)	1	11-09-2026		TLM1	
23.	SQL querying (select and project) using where clause	1	15-09-2026		TLM1	
24.	Arithmetic & logical operations	1	17-09-2026		TLM1	
25.	SQL functions (Date and Time, Numeric, String conversion).	1	18-09-2026		TLM2	
26.	Creating tables with relationship	1	21-09-2026		TLM1	
27.	Implementation of key and integrity constraints	1	22-09-2026		TLM1	
28.	Nested queries, Subqueries, Grouping, Aggregation & Ordering	2	24-09-2026		TLM2	
29.	Implementation of Different types of joins	1	25-09-2026		TLM2	
30.	View (updatable and non-updatable), Relational set operations.	1	28-09-2026		TLM2	
31	Tutorial	1	29-09-2026		TLM3	
No. of classes required to complete UNIT-III: 12				**No. of classes taken:**		

UNIT-IV: Schema Refinement (Normalization)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Purpose of Normalization or schema refinement	1	01-10-2026		TLM1	
33.	Concept of functional dependency	1	05-10-2026		TLM1	
34.	Normal forms based on functional Dependency Lossless join	1	06-10-2026		TLM2	
35.	Dependency preserving Decomposition, (1NF, 2NF and 3NF)	2	08-10-2026 09-10-2026		TLM1	
36.	Concept of Surrogate key, Boyce-Codd normal form (BCNF)	2	12-10-2026 13-10-2026		TLM1	
37.	MVD, Fourth normal form(4NF),	1	15-10-2026		TLM1	
38.	Fifth Normal Form (5NF).	1	16-10-2026		TLM2	
39.	Tutorial	1	26-10-2026		TLM3	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Transaction Processing and Concurrency Control:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Introduction & Transaction state, ACID properties	1	27-10-2026		TLM2	
41.	Concurrent Executions, Serializability	1	29-10-2026		TLM2	
42.	Recoverability & Implementation of Isolation	1	30-10-2026		TLM2	
43.	Testing for Serializability & Two- Phase Locking Techniques for concurrency control	1	02-11-2026		TLM2	
44.	Types of Locks & Time stamp-based locking.	1	03-11-2026		TLM2	
45.	Introduction to Recovery Protocols, No-UNDO/REDO Recovery Based on Deferred Update,	1	05-11-2026		TLM2	
46.	Recovery Techniques Based on Immediate Update, Shadow Paging	1	06-11-2026		TLM2	
47.	ARIES Introduction to Indexing, Hash based Indexing	1	09-11-2026		TLM2	
48.	Tutorial	1	10-11-2026		TLM3	
	No. of classes required to complete UNIT-V: 9			**No. of classes taken:**		

Content Beyond 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	HOD Sign
1.	Creating Tables and different operations on table.(LAB)	1	29-09-2026		TLM4		
No. of classes		1			No. of classes taken:		
II MID EXAMINATIONS (12-11-2026 TO 14-11-2026)							

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 (R23 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III ,IV & V)	A2=5
II- Descriptive Examination (Unit-III ,IV & V)	M2=15
II-Quiz Examination (Unit-III ,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.
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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 modeling 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.
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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	**Dr. O. Rama Devi**	**Dr. O. Rama Devi**	**Dr D. Srinivasa Rao**	**Dr. P.Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor: Dr.Divvela Srinivasa Rao
Course Name & Code : Advanced Data Structures & Algorithm Analysis & 20CS04

L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : BTECH/III SEM-B SEC **AY: 2026-27**

PREREQUISITE: Data Structures

COURSE OBJECTIVES (CEOs):

The main objectives of the course is to

1. Provide knowledge on advance data structures frequently used in Computer Science domain
2. Develop skills in algorithm design techniques popularly used
3. Understand the use of various data structures in the algorithm design

COURSE OUTCOMES (COs): After successful completion of the course the students are able to

CO1	Identify the characteristics of an algorithm, analyze its time and space complexity and construct balanced binary trees. **(Apply-L3)**
CO2	Understand Heap structures and graph terminology to perform various operations on non-linear data structures. **(Understand-L2)**
CO3	Apply Divide and Conquer, Greedy algorithm and dynamic programming for solving problems. **(Apply - L3)**
CO4	Analyze the backtracking and branch-and-bound search methods on optimization problems **(Apply-L3)**
CO5	Summarize the importance of NP-Hard and its applications. **(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	2	3	-	-	-	-	-	-	-	-	-	-	-	-	2
CO2	2	2	-	-	-	-	-	-	-	-	-	-	-	-	1
CO3	2	2	3	-	-	-	-	-	-	-	-	-	-	-	2
CO4	2	2	3	-	-	-	-	-	-	-	-	-	-	-	2
CO5	2	2	-	1	-	-	-	-	-	-	-	-	-	-	1
1 - Low			**2** –Medium							**3** - High					

TEXTBOOKS:

T1 Fundamentals of Data Structures in C++, Horowitz, Ellis; Sahni, Sartaj; Mehta, Dinesh, 2nd Edition Universities Press

T2 Computer Algorithms in C++, Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, 2nd Edition University Press

REFERENCE BOOKS:

R1 Data Structures and program design in C, Robert Kruse, Pearson Education Asia

R2 An introduction to Data Structures with applications, Trembley & Sorenson, Mc Graw Hill

R3 The Art of Computer Programming, Vol.1: Fundamental Algorithms, Donald E Knuth, Addison-Wesley, 1997.

R4 Data Structures using C & C++: Langsam, Augenstein & Tanenbaum, Pearson,1995 Algorithms +Data Structures & Programs: N. Wirth, PHI

R5 Fundamentals of Data Structures in C++: Horowitz Sahni & Mehta, Galgottia Pub.

R6 Data Structures in Java: Thomas Standish, Pearson Education Asia

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction, AVL Trees, B-Trees

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 on Syllabus and CO's**	1	14-7-2026		TLM1	
2.	Introduction to Algorithm Analysis	1	15-7-2026		TLM1	
3.	Characteristics on Algorithm Analysis	1	16-7-2026		TLM1	
4.	Approaches to Designing an Algorithm	1	17-7-2026		TLM1	
5.	Algorithm Analysis & Complexity	1	18-7-2026		TLM1	
6.	Algorithm Analysis Examples	1	21-7-2026		TLM1	
7.	Asymptotic Notations	1	22-7-2026		TLM1	
8.	Asymptotic Notations	1	23-7-2026		TLM1	
9.	**AVL Trees** – Creation, Insertion	1	24-7-2026		TLM1	
10.	AVL Trees – Deletion, Applications	1	25-7-2026		TLM1	
11.	**B-Trees** – Creation, Insertion	1	28-7-2026		TLM1	
12.	B-Trees – Deletion, Applications	1	29-7-2026		TLM1	
13.	Assignment on Time Complexities, AVL Trees and B-Trees	1	30-7-2026		TLM3	
No. of classes required to complete UNIT-I: 13				**No. of classes taken:**		

UNIT-II: Heap Trees, Graphs & Divide and Conquer

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	**Heap Trees (Priority Queues)**	1	31-7-2026		TLM1	
15.	Min and Max Heaps	1	1-8-2026		TLM1	
16.	Operations and its Applications	1	4-8-2026		TLM1	
17.	Implementation of Heap Tree	1	5-8-2026		TLM1	
18.	**Graphs** – Terminology and Representation	1	6-8-2026		TLM1	
19.	Assignment on Heap Sort operations and Graphs	1	7-8-2026		TLM3	
20.	Basic Search and Traversals (BFS)	2	8-8-2026 11-8-2026		TLM1	
21.	Basic Search and Traversals (DFS)	2	12-8-2026 13-8-2026		TLM1	
22.	Connected Components	1	14-8-2026		TLM1	
23.	Bi-Connected Components, Applications	1	18-8-2026		TLM1	
24.	**Divided and Conquer** – The General Method	1	19-8-2026		TLM1	
25	Finding Max – Min	2	20-8-2026 21-8-2026		TLM1	

26.	Quick Sort	2	22-8-2026 25-8-2026		TLM1	
27.	Merge Sort	2	26-8-2026 27-8-2026		TLM1	
28	Strassen's matrix multiplication	3	28-8-2026 29-8-2026 01-9-2026		TLM1	
29.	Assignment on Sorting's, Strassen's matrix multiplication, Rivision	3	02-9-2026 03-9-2026 04-9-2026		TLM3	
No. of classes required to complete UNIT-II: 25				**No. of classes taken:**		

UNIT-III: Greedy Method

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	**Greedy Method:** General Method	1	10-9-2026		TLM1	
31.	Job Scheduling with deadlines	1	11-9-2026		TLM1	
32.	Knapsack Problem	1	12-9-2026		TLM1	
32.	Minimum Cost Spanning Trees	1	15-9-2026		TLM1	
33.	Assignment on Knapsack problems	1	16-9-2026		TLM3	
34.	Single Source Shortest Path	1	17-9-2026		TLM1	
35.	Single Source Shortest Path	1	18-9-2026		TLM1	
36.	Optimal Storage on tapes	1	19-9-2026		TLM1	
37.	Huffman coding	1	22-9-2026		TLM1	
38.	Assignment on Knapsack problem, prims algorithm and Huffman coding	1	23-9-2026		TLM3	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Problems and Algorithms

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	**Introduction to Dynamic Programming**	1	24-9-2026		TLM1	
40.	General Method	1	25-9-2026		TLM1	
41.	All pairs shortest paths	1	26-9-2026		TLM1	
42.	Single source shortest paths	1	29-9-2026		TLM1	
43.	General weights(Bellman Ford Algorithm)	1	30-9-2026		TLM1	
44.	Optimal Binary Search Trees	1	1-10-2026		TLM1	
45.	0/1 Knapsack	1	2-10-2026		TLM1	
46.	String Editing	1	3-10-2026		TLM1	
47.	Travelling Salesperson problem	2	6-10-2026 & 7-10-2026		TLM1	
48.	Assignment on Tabular & Memorization and Travelling Salesperson problems	1	8-10-2026		TLM3	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Back Tracking and Complexity Classes

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	**Back Tracking:** General Method	1	9-10-2026 & 10-10-2026		TLM1	
48.	N-Queens Problem	3	13-10-2026 & 14-10-2026 15-10-2026		TLM1	

49.	Sum of subsets problem	2	16-10-2026 & 17-10-2026		TLM1
50.	Graph Coloring	1	27-10-2026 28-10-2026		TLM1
51.	**Branch and Bound:** General Method	2	30-10-2026& 31-10-2026		TLM1
52.	0/1 Knapsack Problem-LCBB, FIFOBB	2	3-11-26 & 4-11-26		TLM1
53.	Travelling Salesperson problem – LC Search	2	5-11-2026 & 6-11-2026		TLM1
54.	**Introduction to Complexity classes**	1	7-11-2026		TLM1
55.	P and NP Problems	1	10-11-2026		TLM1
56.	NP Complete Problems	1	11-11-2026		TLM1
No. of classes required to complete UNIT-V: 16				**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
1.	Amortized Analysis	1	05-09-2026		TLM1	
2.	NP- Hard Problems	1	11-11-2026		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 (R23 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (Unit-III, IV & V)	M2=15
II-Quiz Examination (Unit-III, 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 modeling 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 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 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	**Dr. D. Srinivasa Rao**	**Dr. D. Srinivasa Rao**	**Dr. D. Srinivasa Rao**	**Dr. P. Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. S. V. V. D. JAGADEESH
Course Name & Code : Object Oriented Programming Through JAVA (23CS05)
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec :II **B.Tech /III Sem /AI & DS - B** **A.Y.:** 2026-27

PREREQUISITE: Introduction to Programming.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. Identify Java language components and how they work together in applications
2. Learn the fundamentals of object-oriented programming in Java, including defining classes, invoking methods, using class libraries.
3. Learn how to extend Java classes with inheritance and dynamic binding and how to use exception handling in Java applications
4. Understand how to design applications with threads in Java
5. Understand how to use Java APIs for program development

COURSE OUTCOMES (CO's): After successful completion of the course the students are able to

CO1	Identify the syntax and semantics of java programming language and basic concepts of java. **(Understand-L2)**
CO2	Understand the basic concepts of object-oriented Programming. **(Understand-L2)**
CO3	Develop array-based problems, reusable programs using the concepts of inheritance, polymorphism, and interfaces. **(Apply-L3)**
CO4	Apply the concepts of packages, exception handling, and I/O streams to develop secure, error free, and efficient applications. **(Apply-L3)**
CO5	Design multithreaded and GUI based applications which mimic the real word scenarios. **(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	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO3	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO4	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO5	3	2	-	-	-	-	-	-	-	-	-	2	2	-	-
1 - Low							**2 –**Medium						**3 –** High		

TEXTBOOKS:

T1 JAVA one step ahead, Anitha Seth, B. L. Juneja, Oxford.
T2 Joy with JAVA, Fundamentals of Object-Oriented Programming, Debasis Samanta, Monalisa Sarma, Cambridge, 2023.
T3 JAVA9 for Programmers, Paul Deitel, Harvey Deitel,4th Edition, Pearson.

REFERENCE BOOKS:

R1 The complete Reference Java,11th edition, Herbert Schildt, TMH
R2 Introduction to Java programming,7th Edition, Y Daniel Liang, Pearson

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to OOP:

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.	**Object Oriented Programming:** Basic concepts	1	13-07-26		TLM 1	
2.	OOP Principles	1	14-07-26		TLM 1	
3.	Program Structure in Java: Introduction, Writing Simple Java Programs	1	15-07-26		TLM 1	
4.	Elements or Tokens in Java Programs, Java Statements, Command Line Arguments	1	17-07-26		TLM 4	
5.	User Input to Programs, Escape Sequences Comments, Programming Style.	1	18-07-26		TLM 4	
6.	**Data Types:** Introduction, Data Types in Java	1	20-07-26		TLM 1	
7.	Declaration of Variables,Type Casting, Scope of Variable Identifier	1	21-07-26		TLM 4	
8.	Literal Constants, Symbolic Constants	1	22-07-26		TLM 1	
9.	Formatted Output with printf() Method	1	24-07-26		TLM 4	
10.	Static Variables and Methods, Attribute Final	1	25-07-26		TLM 4	
11.	Introduction to Operators: Precedence and Associativity of Operators, Assignment Operator (=),	1	27-07-26		TLM 4	
12.	Basic Arithmetic Operators, Increment (++) and Decrement (- -) Operators, Ternary Operator, Relational Operators, Boolean Logical Operators, Bitwise Logical Operators.	1	28-07-26		TLM 4	
13.	**Control Statements:** Introduction, if Expression, Nested if Expressions, if–else Expressions	1	29-07-26		TLM 4	
14.	Ternary Operator?:, Switch Statement	1	31-07-26		TLM 4	
15.	Iteration Statements, while Expression, do–while Loop, for Loop, For–Each for Loop	1	01-08-26		TLM 4	
16.	Nested for Loop, Break Statement, Continue Statement.	1	03-08-26		TLM 4	
No. of classes required to complete UNIT-I: 16				**No. of classes taken:**		

UNIT-II: Classes and Objects, String Handling

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	**Classes and Objects:** Introduction, Class Declaration and Modifiers	1	04-08-26		TLM 1	
18.	Class Members, Declaration of	1	05-08-26		TLM 1	

	Class Objects					
19.	Assigning One Object to Another, Access Control for Class Members	1	07-08-26		TLM 4	
20.	Access Control for Class Members, Accessing Private Members of Class.	1	08-08-26		TLM 4	
21.	**Constructors and Methods:** Introduction, Defining Methods, Constructor Methods for Class,	1	10-08-26		TLM 1	
22.	Overloaded Constructor Methods, Overloaded Methods, Nested Classes	1	11-08-26		TLM 4	
23.	Passing Arguments by Value and by Reference, Keyword this.	1	12-08-26		TLM 4	
24.	Class Objects as Parameters in Methods, Access Control	1	14-08-26		TLM 4	
25.	Recursive Methods, Nesting of Methods	1	17-08-26		TLM 4	
26.	Attributes Final and Static	1	18-08-26		TLM 4	
27.	**String Handling in Java:** Introduction, Interface Char Sequence	1	19-08-26		TLM 1	
28.	Class String, Methods for Extracting Characters from Strings	1	21-08-26		TLM 4	
29.	Comparison, Modifying, Searching	1	22-08-26		TLM 4	
30.	Other methods of String class	1	24-08-26		TLM 1	
31.	String Buffer	1	25-08-26		TLM 1	
32.	Methods of String Buffer	1	26-08-26		TLM 1	
33.	Revision I & II Units	1	28-08-26		TLM 1	
No. of classes required to complete UNIT-II: 17				**No. of classes taken:**		

UNIT-III: Arrays, Inheritance and Interfaces

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
34.	**Arrays:** Introduction, Declaration and Initialization of Arrays, Storage of Array in Computer Memory, Accessing Elements of Arrays	1	29-08-26		TLM 1	
35.	Operations on Array Elements, Assigning Array to Another Array, Dynamic Change of Array Size	1	31-08-26		TLM 4	
36.	Sorting of Arrays, Search for Values in Arrays, Class Arrays	1	01-09-26		TLM 4	
37.	Two-dimensional Arrays, Arrays of Varying Lengths Three-dimensional Arrays, Arrays as Vectors.	1	02-09-26		TLM 4	
38.	**Inheritance:** Introduction, Relationship between classes- Has-a, Is-a, Process of Inheritance	1	05-09-26		TLM 4	
39.	Types of Inheritances	1	11-09-26		TLM 1	
40.	Universal Super Class-Object Class, Inhibiting Inheritance of Class Using Final, Access Control and Inheritance	1	12-09-26		TLM 4	
41.	Multilevel Inheritance, Application	1	15-09-26		TLM 4	

	of Keyword Super					
42.	Constructor Method and Inheritance, Method Overriding	1	16-09-26		TLM 4	
43.	Dynamic Method Dispatch, Abstract Classes.	1	18-09-26		TLM 4	
44.	**Interfaces:** Introduction, Declaration of Interface, Implementation of Interface	1	19-09-26		TLM 4	
45.	Multiple Interfaces, Nested Interfaces, Inheritance of Interfaces, Default Methods in Interfaces	1	21-09-26		TLM 4	
46.	Inheritance of Interfaces, Default Methods in Interfaces	1	22-09-26		TLM4	
47.	Static Methods in Interface	1	23-09-26		TLM4	
48.	Functional Interfaces, Annotations.	1	25-09-26		TLM 4	
No. of classes required to complete UNIT-III: 15				**No. of classes taken:**		

UNIT-IV: Packages and Java Library, Exception Handling, JAVA I/O and File

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
49.	Introduction, Defining Package, Importing Packages and Classes into Programs, Path and Class Path	1	26-09-26		TLM 1	
50.	Access Control	1	28-09-26		TLM 4	
51.	Packages in Java SE- Java. Lang Package and its Classes, Class Object	1	29-09-26		TLM 4	
52.	Enumeration, class Math, Wrapper Classes	1	30-09-26		TLM 4	
53.	Auto-boxing and Auto-unboxing. java util Classes and Interfaces	1	03-10-26		TLM 4	
54.	Formatter Class, Random Class	1	05-10-26		TLM 1	
55.	Time Package, Formatting for Date/Time in Java, Temporal Adjuster Class	1	06-10-26		TLM 1	
56.	Exception Handling: Introduction, Hierarchy of Standard Exception Classes, Keywords try, catch, throw, throws, and finally Blocks	1	07-10-26		TLM 1	
57.	Multiple Catch Clauses, Class Throwable, Unchecked Exceptions, Checked Exceptions, generating user defined exception.	1	09-10-26		TLM 4	
58.	**Java I/O and File:** Java I/O API, standard I/O streams types, Byte streams	1	10-10-26		TLM 4	
59.	Character streams, Scanner class, Files in Java	1	12-10-26		TLM 1	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: MultiThreading, Collections, JAVA FX GUI:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
60.	**Multithreaded Programming:** Introduction, Need for Multiple Threads	1	13-10-26		TLM 1	

61.	Multithreaded Programming for Multi-Core Processor, Thread Class, Main Thread - Creation of New Threads	1	14-10-26		TLM 4	
62.	Thread States, Thread Priorities	1	16-10-26		TLM 4	
63.	Synchronization	1	17-10-26		TLM 4	
64.	Inter-thread Communication-producer consumer problem.	1	26-10-26		TLM 4	
65.	**Java Collections:** Introduction, Purpose of Collection Framework, Hierarchy of collection Interfaces / classes	1	27-10-26		TLM 1	
66.	Methods defined in Collection Interface, Interface Iterator	1	28-10-26		TLM 4	
67.	Collection classes/Interfaces List	1	30-10-26		TLM 4	
68.	Collection classes/Interfaces List	1	31-10-26		TLM 4	
69.	Collection classes/Interfaces List	1	02-11-26		TLM 4	
70.	**Java FX GUI:** Overview of AWT & Swings API, limitations	1	03-11-26		TLM 1	
71.	**Java FX GUI:** Overview of AWT & Swings API, limitations	1	04-11-26		TLM 1	
72.	Displaying text and image		06-11-26		TLM 1	
73.	event handling, mouse events	1	07-11-26		TLM 1	
74.	laying out nodes in scene graph	1	09-11-26		TLM 1	
No. of classes required to complete UNIT-V: 15				**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
75.	Introduction to JDBC	1	10-11-26		TLM 1	
76.	Introduction to JavaScript	1	11-11-26		TLM 1	

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	**Mr. S.V.V.D.Jagadeesh**	**Dr. Y Vijaya Bhaskar Reddy**	**Dr. B. Phani Krishna**	**Dr. P. Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mrs. K Lakshmi Padmavathi
Course Name & Code : Universal Human Values - II: Understanding Harmony (23HS01)
L-T-P Structure : 3-0-0 **Credits** : 3
Program/Sem/Sec : B.Tech III Semester – AI & DS-B **A.Y.** : 2026-27

PREREQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- To help the students appreciate the essential complementary between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
- To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
- To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.

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

CO1	Define the terms like Natural Acceptance, Happiness and Prosperity **(L1, L2)**
CO2	Identify one's self, and one's surroundings (family, society nature) **(L1, L2)**
CO3	Relate human values with human relationship and human society. **(L2)**
CO4	Illustrate the need for universal human values and harmonious existence(**L2**)
CO5	Develop as socially and ecologically responsible engineers (**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								2							
CO2			2					3							
CO3						2		3	2						
CO4						1		2							
CO5							2	3				1			

TEXT BOOKS:

T1 R R Gaur, r singal, G P Bagaria, "Human values and Professional Ethics", Excel Books, New Delhi,2010

REFERENCE BOOKS:

R1 Jeevan vidya: Ek Parichaya, A.Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999

R2 Human values, A N Tripathi, New Age Publishers, New Delhi, 2004

R3 The story of my experiments with Truth, Mohandas Karamchand Gandhi

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Value Education

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, COs	1	15-07-2026		TLM2	
2.	Process for self exploration: Natural Acceptance	1	15-07-2026		TLM.2	
3.	Right Understanding, Relationship and Physical Facility	2	17-07-2026 18-07-2026		TLM2	
4.	Understanding Value Education	2	22-07-2026		TLM2	
5.	self-exploration as the Process for Value Education	1	24-07-2026		TLM2	
6.	Continuous Happiness and Prosperity	1	25-07-2026		TLM2	
7.	Happiness and Prosperity	2	29-07-2026		TLM2	
8.	Basic Human Aspirations	2	31-07-2026 01-08-2026		TLM2	
9.	Method to Fulfill the Basic Human Aspirations	2	05-08-2026		TLM2	
10.	Tutorial-1	2	07-08-2026 08-08-2026		TLM2	
No. of classes required to complete UNIT-I: 16				**No. of classes taken:**		

UNIT-II: Harmony in the Human Being

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Understanding Human being as the Co-existence of the self and the body	2	12-08-2026		TLM2	
12.	Distinguishing between the Needs of the self and the body	1	14-08-2026		TLM2	
13.	The body as an Instrument of the self	2	19-08-2026		TLM2	
14.	Understanding Harmony in the self	2	21-08-2026 22-08-2026		TLM2	
15.	Harmony of the self with the body	2	28-08-2026 29-08-2026		TLM2	
16.	Programme to ensure self-regulation and Health	2	02-09-2026		TLM2	
17.	Tutorial - 1	1	05-09-2026		TLM2	
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT III: Harmony in the Family and Society

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18.	Harmony in the Family	1	11-09-2026		TLM2	
19.	'Trust' – the Foundational Value in Relationship	1	12-09-2026		TLM2	
20.	Practice Session PS7 Exploring the Feeling of Trust	2	16-09-2026		TLM2	
21.	'Respect' – as the Right Evaluation	1	18-09-2026		TLM1	
22.	Practice Session PS8 Exploring the Feeling of Respect	1	19-09-2026		TLM2	
23.	Other Feelings, Justice in Human-to-Human Relationship	2	23-09-2026		TLM2	
24.	Understanding Harmony in the Society	1	25-09-2026		TLM2	
25.	Vision for the Universal Human Order	1	26-09-2026		TLM2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: Harmony in the Nature/Existence

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	Understanding Harmony in the Nature	2	30-09-2026		TLM2	
27.	Interconnectedness, self-regulation	1	03-10-2026		TLM2	
28.	Mutual Fulfilment among the Four Orders of Nature	2	07-10-2026		TLM2	
29.	Realizing Existence as Co-existence at All Levels	2	09-10-2026 10-10-2026		TLM2	
30.	The Holistic Perception of Harmony in Existence	2	14-10-2026		TLM2	
31.	Tutorial -1	2	16-10-2025 17-10-2025		TLM2	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Implications of the Holistic Understanding

S. No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
32.	Natural acceptance of human values	2	28-10-2025		TLM2	
33.	Definitiveness of ethical human conduct	1	30-10-2026		TLM2	
34.	Basis for humanistic education	1	31-10-2026		TLM2	
35.	A Basis for Humanistic Education, Humanistic Constitution and Universal Human	2	04-11-2026		TLM2	
36.	Competence in professional ethics	1	06-11-2026		TLM2	
37.	Strategy for transition from the present state to universal human order	1	07-11-2026		TLM2	
38.	Holistic Technologies, Production Systems and Management Models-Typical Case	2	11-11-2026		TLM2	
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

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 (R17 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
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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	K. Lakshmi Padmavathi	Dr.B.SrinivasaRao	K. Lakshmi Padmavathi	Dr.P.Bhagath
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.Divvela Srinivasa Rao
Course Name & Code : Advanced Data Structures & Algorithm Analysis Lab & 23CS53
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : BTECH/III/B **A.Y.:** 2025-26

PREREQUISITE: Data Structures Lab

COURSE EDUCATIONAL OBJECTIVE(CE0):

The objectives of the course is to

- Acquire practical skills in constructing and managing Data structures
- Apply the popular algorithm design methods in problem-solving scenarios

COURSE OUTCOMES (CO):

CO1: Implement balanced binary trees, heaps and graph traversals using arrays and linked list. **(Apply-L3)**
CO2: Implement Various Sorting Techniques. **(Apply -L3)**
CO3: Implement optimization problems using greedy, dynamic programming, back tracking and branch-and-bound techniques. **(Apply - L3)**
CO4: Improve individual/team work skills, communication & report writing skills with ethical values.

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO1	-	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO2	-	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO3	-	2	1	-	-	-	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

Note: 1 - Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign
1.	AVL Tree operations using linked list	3	13-7-2026		
2.	B-Tree operations	3	20-7-2026		
3.	Min and Max Heap using arrays	3	27-7-2026		
4.	BFT and DFT for given graph	3	03-8-2026		
5.	BFT and DFT for given graph	3	10-8-2026		
6.	Bi-connected components in a given graph	3	17-8-2026		
7.	Find maximum and minimum element in array using Divide and conquer.	3	24-8-2026		
8.	Quick Sort & Merge Sort	3	31-8-2026 & 14-9-2026		
9.	Single Source Shortest Paths using Greedy method	3	21-9-2026 & 28-9-2026		
10.	Job Sequencing with deadlines using Greedy strategy	3	05-10-2026		
11.	0/1 Knapsack problem Using Dynamic Programming	3	12-10-2026		
12.	N-Queens Problem Using Backtracking	3	26-10-2026		
13.	Travelling Sales Person problem using Branch and Bound approach	3	02-11-2026		
14.	Internal Exam	3	09-11-2026		

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
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.
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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 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	**Dr. D. Srinivasa Rao**	**Dr. D. Srinivasa Rao**	**Dr. D. Srinivasa Rao**	**Dr. P. Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor: Mr. S.V.V.D.JAGADEESH, Dr. B. Phani Krishna, V. Sowjanya
Course Name & Code : Object Oriented Programming Through JAVA Lab (23CS54)
L-T-P Structure : 0-0-3 **Credits:** 1.5
Program/Sem/Sec : II B.Tech III Sem AI & DS - B **A.Y.:** 2026-27

PRE-REQUISITE: INTRODUCTION TO PROGRAMMING AND DATA STRUCTURES

COURSE EDUCATIONAL OBJECTIVES (CEOs):

1. Introduce core programming concepts of Python programming language.
2. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications.

COURSE OUTCOMES (COs): After successful completion of the course the students are able to

CO 1	Implement basic concepts of the java programming language. **(Apply-L3)**
CO 2	Implement object-oriented programming and exception handling. **(Apply-L3)**
CO 3	Design multithreaded, database and GUI based applications. **(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	3	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO2	3	2	2	-	2	-	-	-	-	-	-	2	2	-	-
CO3	3	2	2	-	2	-	-	-	-	-	-	2	2	-	-
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	Revision of C	3	14-07-26		TLM4	
2	Week-1 Programs on Operators, conditional statements	3	21-07-26		TLM4	
3	Week-2 Programs on searching and sorting	3	28-07-26		TLM4	
4	Week-3 Programs on class, methods and constructors	3	04-08-26		TLM4	
5	Week-4 Inheritance and Abstract classes	3	11-08-26		TLM4	
6	Week-5 Super keyword	3	18-08-26		TLM4	
7	Week-5 Interfaces and Polymorphism	3	25-08-26		TLM4	
8	Week-6 Programs on Exception Handling	3	01-09-26		TLM4	
9	Week-7 Programs on multi Threading	3	15-09-26		TLM4	
10	Week-7 Programs on multi Threading	3	22-09-26		TLM4	
11	Week-8 Programs on packages,JAVA FX GUI	3	29-09-26		TLM4	
12	Week-9 Programs on JAVA FX GUI	3	06-10-26		TLM4	
13	Week-9 Programs on Collection Framework	3	13-10-26		TLM4	
14	Week-9 Programs on Collection Framework	3	27-10-26		TLM4	
14	Internal Exam	3	03-11-26		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 (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
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Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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	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	**Mr. S.V.V.D.Jagadeesh**	**Dr. Y. Vijaya Bhaskar Reddy**	**Dr. B. Phani Krishna**	**Dr. P. Bhagath**
Signature				

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

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: V. Chandra Kumar
Course Name & Code **:** PYTHON PROGRAMMING **(SEC-B)** & 23CSS1
L-T-P Structure **: 0-1-2** **Credits:** 2
Program/Sem/Sec : B.Tech/AI&DS/III/B **A.Y.:** 2026-27

PREREQUISITE: INTRODUCTION TO PROGRAMMING

COURSE EDUCATIONAL OBJECTIVE:

The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

COURSE OUTCOMES (CO):

CO1: Implement the core programming concepts of Python programming language**. (Apply-L3)**
CO2: Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries **(Apply-L3)**
CO3: Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications**. (Apply-L3)**
CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values

COURSE ARTICULATION MATRIX (Correlation between Cos, Pos & PSOs):

Cos	PO 1	PO 2	PO3	PO 4	PO 5	PO6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	2	-	
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	-	
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	-	
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

Note: 1- Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

PART-B:

COURSE DELIVERY PLAN (LESSON PLAN):

S.NO	Topic to be covered	Number of Hours	Tentative Date of Completion	Actual Date of Completion	HOD Signature
1.	**UNIT-1:** Introduction- Course Outcomes,	1	15-07-2026		
2.	Python Installation, Variables, Data types Reading Input, print output, Comments, Types of operators, Working on operators, Sample Programs,	3	16-07-2026		
3.	Type Conversion, Control statements – if, else, nestedif, elif, Introduction to Loop statements	1	17-07-2026		
4.	Programs on Loop statements, pass, continue and break	3	23-07-2026		
5.	Exception Handling	1	24-07-2026		
6.	Programs on exception handling.	3	30-07-2026		
7.	**UNIT-2:** Function Definition and Calling the function, return Statement and void Function	1	31-07-2026		
8.	Scope and Lifetime of Variables, Default Parameters, Keyword Arguments, *args and **kwargs, Command Line Arguments, sample programs.	3	6-08-2026		
9.	Strings Introduction, Basic String Operations, Accessing Characters in String by Index Number, String Slicing and Joining, String Methods,	1	7-08-2026		
10.	Formatting Strings., Sample Programs on strings	3	13-08-2026		
11.	List introduction, operations	1	14-08-2026		
12.	Creating Lists, Basic List Operations, Indexing and Slicing in Lists,	1	28-08-2026		
13.	Built-In Functions Used on Lists, List Methods, del Statement., Programs on Lists	3	3-09-2026		
14.	**Unit-3:** Introduction to Dictionaries, Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Sample programs on dictionaries.	3	10-09-2026		
15.	Creating Tuples, Basic Tuple Operations, tuple() Function, Tuple Indexing and Slicing, Built-In Functions Used on Tuples, Sample Programs on tuples.	1	11-09-2026		
16.	Relation between Tuples and Lists, Relation between Tuples and Dictionaries, Using zip() Function	3	17-09-2026		
17.	Programs on Tuples, Sets, Set Methods, Frozenset., Sample Programs on sets, tuples.	1	18-09-2026		
18.	**Unit-4**: Introduction to files	1	22-09-2026		
19.	Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, sample programs on files.	3	24-09-2026		

20.	Pickle Module	1	25-09-2026		
21.	Reading and Writing CSV Files, Python os and os.path Modules. Sample programs.	3	1-10-2026		
22.	**Object-Oriented Programming**: Creating Classes and Objects in Python, Constructor Method	1	6-10-2026		
23.	Classes with Multiple Objects, Class Attributes Vs Data Attributes, sample programs. Sample Python programs on object-oriented programming.	3	8-10-2026		
24.	Concept of Encapsulation, Inheritance, Polymorphism	1	9-10-2026		
25.	**Unit 5: Introduction to Data Science**: Functional Programming, JSON and XML in Python, NumPy with Python, Pandas.	3	15-10-2026		
26.	Example Programs on Numpy and pandas.	1	16-10-2026		
27.	Practice Programs on Pandas	3	29-10-2026		
28.	Practice Programs on Numpy	1	30-10-2026		
29.	**Internal Exam**		5-11-2026		

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	**Marks**
Day to Day Work: (Day-to-Day—10M + Record -5M)	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
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 modeling 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 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 engineeringand 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	The ability to apply Software Engineering practices and strategies in software project development using open-source programming environment for the success of Organization.
PSO 2	The ability to design and develop computer programs in networking, web applications and IoT as per the society needs.
PSO 3	To inculcate an ability to analyze, design and implement database applications.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Mr.V. Chandra Kumar**	**Dr. G. Minni**	**Dr. B. Phani Krishna**	**Dr.P.Bhagath**
Signature				