



**REFERENCE BOOKS:**

1. Data Mining: VikramPudi and P. Radha Krishna, Oxford Publisher.
2. Data Mining Techniques, Arun K Pujari, 3<sup>rd</sup> edition, Universities Press,2013.
3. (NPTEL course by Prof.PabitraMitra) [http://onlinecourses.nptel.ac.in/noc17\\_mg24/preview](http://onlinecourses.nptel.ac.in/noc17_mg24/preview)
4. [http://www.saedsayad.com/data\\_mining\\_map.htm](http://www.saedsayad.com/data_mining_map.htm)

**PART-B****COURSE DELIVERY PLAN (LESSON PLAN): Data Warehousing and Data Mining (23AD04)****UNIT-I: Data Warehousing and Online Analytical Processing**

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.	Discussion of CO'S and CEO'S	1	29/06/2026		TLM1 & 2	
2.	Basic concepts	1	30/06/2026		TLM1 & 2	
3.	Data Warehouse Modeling: Data Cube and OLAP	1	02/07/2026		TLM1 & 2	
4.	Data Warehouse Design and Usage	1	06/07/2026		TLM1 & 2	
5.	Data Warehouse Implementation	1	07/07/2026		TLM1 & 2	
6.	Cloud Data Warehouse	1	09/07/2026		TLM1 & 2	
7.	Data Mining and Patten Mining	1	13/07/2026		TLM1 & 2	
8.	Technologies, Applications, Major issues	1	14/07/2026		TLM1 & 2	
9.	Data Objects & Attribute Types	1	16/07/2026		TLM1 & 2	
10.	Basic Statistical Descriptions of Data	1	20/07/2026		TLM1 & 2	
11.	Data Visualization	1	21/07/2026		TLM1 & 2	
12.	Measuring Data Similarity and Dissimilarity	1	23/07/2026		TLM1 & 2	
<b>No. of classes required to complete UNIT-I: 12</b>				<b>No. of classes taken:</b>		

**UNIT-II: Data Pre-processing**

S No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	An Overview, Data Cleaning	1	27/07/2026		TLM1 & 2	
14.	Data Integration	2	28/07/2026 – 30/07/2026		TLM1 & 2	
15.	Data Reduction	2	03/08/2026 – 04/08/2026		TLM1 & 2	
16.	Data Transformation	2	06/08/2026 – 10/08/2026		TLM1 & 2	
17.	Data Discretization	2	11/08/2026 – 13/08/2026		TLM1 & 2	
<b>No. of classes required to complete UNIT-II: 09</b>				<b>No. of classes taken:</b>		

**UNIT-III: Classification**

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.	Basic Concepts, General Approach to solving a classification problem	1	17/08/2026		TLM1 & 2	
19.	Decision Tree Induction: Attribute Selection Measures	2	18/08/2026 - 20/08/2026		TLM1 & 2	
20.	Tree Pruning	1	31/08/2026		TLM1 & 2	
21.	Scalability and Decision Tree Induction,	1	01/09/2026		TLM1 & 2	
22.	Visual Mining for Decision Tree Induction	1	03/09/2026		TLM1 & 2	
23.	Bayesian Classification Methods: Bayes Theorem	2	07/09/2026 - 08/09/2026		TLM1 & 2	
24.	Naïve Bayes Classification	2	10/09/2026 - 15/09/2026		TLM1 & 2	
25.	Rule-Based Classification	1	17/09/2026		TLM1 & 2	
26.	Model Evaluation and Selection	1	21/09/2026		TLM1 & 2	
<b>No. of classes required to complete UNIT-III: 12</b>				<b>No. of classes taken:</b>		

**UNIT-IV: Association Analysis**

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.	Problem Definition	1	22/09/2026		TLM1 & 2	
28.	Frequent Item set Generation	1	24/09/2026		TLM1 & 2	
29.	Rule Generation: Confident Based Pruning	2	28/09/2026 - 29/09/2026		TLM1 & 2	
30.	Rule Generation in Apriori Algorithm	1	01/10/2026		TLM1 & 2	
31.	Compact Representation of frequent item sets	1	05/10/2026		TLM1 & 2	
32.	FP-Growth Algorithm	1	06/10/2026		TLM1 & 2	
<b>No. of classes required to complete UNIT-IV: 07</b>				<b>No. of classes taken:</b>		

**UNIT-V: Cluster Analysis**

S No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	Overview, Basics and Importance of Cluster Analysis	1	08/10/2026		TLM1 & 2	
34.	Clustering techniques, Different Types of Clusters	1	12/10/2026		TLM1 & 2	
35.	K-means: The Basic K-means Algorithm	1	13/10/2026		TLM1 & 2	
36.	K-means Additional Issues, Bi-secting K Means	1	15/10/2026		TLM1 & 2	
37.	Agglomerative Hierarchical Clustering: Basic Agglomerative Hierarchical Clustering Algorithm	1	26/10/2026		TLM1 & 2	
38.	DBSCAN: Traditional Density Center-Based Approach	1	27/10/2026		TLM1 & 2	
39.	DBSCAN Algorithm	1	29/10/2026		TLM1 & 2	
40.	Strengths and Weaknesses	1	29/10/2026		TLM1 & 2	
<b>No. of classes required to complete UNIT-V: 08</b>				<b>No. of classes taken:</b>		

### 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
50		1			TLM5	

Teaching Learning Methods			
<b>TLM1 &amp; 2</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	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, I))	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):

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design/development of solutions:</b> 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.

<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> 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.
<b>PO 5</b>	<b>Modern tool usage:</b> 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
<b>PO 6</b>	<b>The engineer and society:</b> 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
<b>PO 7</b>	<b>Environment and sustainability:</b> Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
<b>PO 8</b>	<b>Ethics:</b> Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	<b>Communication:</b> 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.
<b>PO 11</b>	<b>Project management and finance:</b> 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.
<b>PO 12</b>	<b>Life-long learning:</b> 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):**

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
<b>Mr. M. Kishore Kumar</b>	<b>Dr. D. Venkata Subbaiah</b>	<b>Dr. V. Surya Narayana</b>	<b>Dr. P. Bhagath</b>



# LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

## COURSE HANDOUT

### PART-A

Name of Course Instructor: Mr.K.VENKATESH

Course Name & Code : PRINCIPLES OF MACHINE LEARNING & 23AM03

L-T-P Structure : 3-0-0

Credits: 3

Program/Sem/Sec : B. Tech/V/A

A.Y.: 2026-27

PREREQUISITES : Probability and Statistics, Data Warehousing and Data Mining

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of the course are to

- Define machine learning and its different types (supervised and unsupervised) and understand their applications.
- Apply supervised learning algorithms including decision trees and k-nearest neighbours (k-NN).
- Implement unsupervised learning techniques, such as K-means clustering

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

CO1	Understand development steps of model building and evaluation approaches. (Understand-L2)
CO2	Apply Nearest Neighbor-based models to solve real-time regression and classification problems (Apply-L3)
CO3	Make use of supervised learning algorithms to solve classification problems (Apply-L3)
CO4	Apply linear discriminants and perceptron classifiers to classify datasets (Apply-L3)
CO5	Learn advanced learning techniques to deal with complex data. (Apply-L3)

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

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

### TEXTBOOKS:

T1: "Machine Learning Theory and Practice", M N Murthy, V S Ananthanarayana, Universities Press (India), 2024

T2: Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India ,1st edition,2015.

### REFERENCE BOOKS:

R1 "Machine Learning", TomM. Mitchell, McGraw-Hill Publication, 2017

R2 "Machine Learning in Action", Peter Harrington, Dream Tech.

R3 "Introduction to Data Mining", Pang-Ning Tan, Michel Stenbach, Vipin Kumar, 7<sup>th</sup> Edition, 2019.

R4 "Understanding Machine Learning: From Theory to Algorithms" Shai Shalev-Shwartz, ShaiBen David, Cambridge.

### Web Resources:

<https://nptel.ac.in/courses/106106139>

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN):

#### UNIT-I: Introduction to Machine Learning

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 Course and COs	1	29-06-2026		TLM1,2	
2.	Evolution of Machine Learning	1	30-06-2026		TLM1,2	
3.	Paradigms for ML	2	01-07-2026 02-07-2026		TLM1,2	
4.	Learning by Rote, Learning by Induction	1	06-07-2026		TLM1,2	
5.	Reinforcement Learning, Types of Data	3	07-07-2026 08-07-2026 09-07-2026		TLM1,2	
6.	Matching, Stages in Machine Learning,	2	13-07-2026 14-07-2026		TLM1,2	
7.	Data Acquisition, Feature Engineering,	2	15-07-2026 16-07-2026		TLM1,2	
8.	Data Representation, Model Selection	2	20-07-2026 21-07-2026		TLM1,2	
9.	Model Learning, Model Evaluation	2	22-07-2026 23-07-2026		TLM1,2	
10.	Model Prediction, Search and Learning, Data Sets.	2	27-07-2026 28-07-2026		TLM1,2	
<b>No. of classes required to complete UNIT-I: 18</b>				<b>No. of classes taken:</b>		

#### UNIT-II: Nearest Neighbor-Based Models

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 Proximity Measures	1	29-07-2026		TLM1,2	
2.	Distance Measures, Non-Metric Similarity Functions,	2	30-07-2026 03-08-2026		TLM1,2	
3.	Proximity Between Binary Patterns	1	04-08-2026		TLM1,2	
4.	Different Classification Algorithms Based on the Distance Measures	2	05-08-2026 06-08-2026		TLM1,2	
5.	K-Nearest Neighbor Classifier	2	10-08-2026 11-08-2026		TLM1,2	
6.	Radius Distance Nearest Neighbor Algorithm	1	12-08-2026		TLM1,2	
7.	KNN Regression, Performance of Classifiers	2	13-08-2026 17-08-2026		TLM1,2	
8.	Performance of Regression Algorithms	1	18-08-2026		TLM1,2	
9.	<b>Unit-1 and 2 Revision</b>	2	19-08-2026 20-08-2026		TLM1,2	
<b>No. of classes required to complete UNIT-II: 14</b>				<b>No. of classes taken:</b>		

### UNIT-III: Models Based on Decision 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.	Decision Trees for Classification	1	31-08-2026		TLM1,2	
2.	Impurity Measures ,Properties	1	01-09-2026		TLM1,2	
3.	Regression Based on Decision Trees, Bias–Variance Trade-off,	1	02-09-2026		TLM1,2	
4.	Random Forests for Classification and Regression	1	03-09-2026		TLM1,2	
5.	The Bayes Classifier: Introduction to the Bayes Classifier	1	07-09-2026		TLM1,2	
6.	Bayes’ Rule and Inference,	1	08-09-2026		TLM1,2	
7.	The Bayes Classifier and its Optimality	1	09-09-2026		TLM1,2	
8.	Multi-Class Classification   Class Conditional Independence and Naive Bayes Classifier (NBC)	2	10-09-2026 15-09-2026		TLM1,2	
<b>No. of classes required to complete UNIT-III: 09</b>				<b>No. of classes taken:</b>		

### UNIT-IV: Linear Discriminants for Machine Learning

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 Linear Discriminants	1	16-09-2026		TLM1,2	
2.	Linear Discriminants for Classification	1	17-09-2026		TLM1,2	
3.	Perceptron Classifier, Perceptron Learning Algorithm	2	21-09-2026 22-09-2026		TLM1,2	
4.	Support Vector Machines, Linearly Non-Separable Case	2	23-09-2026 24-09-2026		TLM1,2	
5.	Non-linear SVM, Kernel Trick	1	28-09-2026		TLM1,2	
6.	Logistic Regression, Linear Regression	2	29-09-2026 30-09-2026		TLM1,2	
7.	Multi-Layer Perceptrons (MLPs)	1	01-10-2026		TLM1,2	
8.	Backpropagation for Training an MLP.	1	05-10-2026		TLM1,2	
<b>No. of classes required to complete UNIT-IV: 11</b>				<b>No. of classes taken:</b>		

## UNIT-V: Other Types of Learning

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.	Ensemble Learning- Bagging, Boosting	2	06-10-2026 07-10-2026		TLM1,2	
2.	Stacking and its impact on bias and variance	1	08-10-2026		TLM1,2	
3.	AdaBoost	1	12-10-2026		TLM1,2	
4.	Gradient Boosting Machines,	1	13-10-2026		TLM1,2	
5.	XGBoost	1	14-10-2026		TLM1,2	
6.	Reinforcement Learning	2	15-10-2026 26-10-2026		TLM1,2	
7.	Q Learning	1	27-10-2026		TLM1,2	
<b>No. of classes required to complete UNIT-V: 09</b>				<b>No. of classes taken:</b>		

## 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.	Combining Inductive and Analytical Learning	1	28-10-2026		TLM1,2	
2.	Case Study of Analytics Learning	1	29-10-2026		TLM1,2	

## Teaching Learning Methods

<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT(NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	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))	<b>M=30</b>
<b>Cumulative Internal Examination (CIE): M</b>	<b>30</b>
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

## PART-D

### PROGRAMME OUTCOMES (POs):

PO 1	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	<b>Problem analysis:</b> 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 5	<b>Modern tool usage:</b> 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.
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PO 7	<b>Environment and sustainability:</b> 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 9	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	<b>Communication:</b> 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.
PO11	<b>Project management and finance:</b> 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.
PO12	<b>Life-long learning:</b> 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				
Signature				



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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

## COURSE HANDOUT

### PART-A

**Name of Course Instructor: Mr. G Rambabu**

**Course Name & Code : DATA VISUALIZATION (23AD05)**

**L-T-P Structure : 3-0-0**

**Credits: 3**

**Program/Sem/Sec : III B.Tech /V Sem /AI & DS - A**

**A.Y.: 2026-27**

**PREREQUISITE:** Computer Graphics, Image Processing.

#### **COURSE EDUCATIONAL OBJECTIVES (CEOs):**

To familiarize students with the basic and advanced techniques of information visualization and scientific visualization, learn key techniques of the visualization process, a detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques.

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

<b>CO1</b>	Explain the basic principles of Data Visualization. ( <b>Understand-L2</b> )
<b>CO2</b>	Apply visualization techniques to a problem and its associated dataset. ( <b>Apply-L3</b> )
<b>CO3</b>	Apply structured approach to create effective visualization. ( <b>Apply-L3</b> )
<b>CO4</b>	Explain about the valuable insights from the massive dataset using visualization. ( <b>Understand-L2</b> )
<b>CO5</b>	Build visualization dashboard to support decision making. ( <b>Apply-L3</b> )

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

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

#### **TEXTBOOKS:**

- T1** WARD, GRINSTEIN, KEIM. Interactive Data Visualization: Foundations, Techniques, and Applications. Natick : A K Peters, Ltd, 2nd Edition.
- T2** E. Tufte, The Visual Display of Quantitative Information, Graphics Press.

#### **REFERENCE BOOKS:**

- R1** Visualization Analytics & Design, Tamara Munzner, AK Peters Visualization Series, 1st Edition.
- R2** Interactive Data Visualization for the Web, Scott Murray, 2nd Edition.

#### **e-Resources:**

- [https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main\\_6up.pdf](https://kdd.cs.ksu.edu/Courses/CIS536/Lectures/Slides/Lecture-34-Main_6up.pdf)
- <https://elearn.nptel.ac.in/shop/iit-workshops/completed/data-visualization-with-r/?v=c86ee0d9d7ed>
- <https://www.geeksforgeeks.org/data-visualization-and-its-importance>.

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN):

#### UNIT-I: Introduction to Visualization

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.	What Is Visualization? History of Visualization	1	29-06-2026		TLM 1,2	
2.	Relationship between Visualization and Other Fields	1	02-07-2026		TLM 1,2	
3.	The Visualization Process- Steps in visualization process	1	02-07-2026		TLM 1,2	
4.	The Visualization Process- Steps in visualization process	1	03-07-2026		TLM 1,2	
5.	Introduction of visual perception	1	06-07-2026		TLM 1,2	
6.	Data representations in visual perception	1	09-07-2026		TLM 1,2	
7.	visual representation of data	1	09-07-2026		TLM 1,2	
8.	Gestalt principles	1	10-07-2026		TLM 1,2	
9.	information overloads.	1	13-07-2026		TLM 1,2	
10.	Case Study: Understanding the Impact of COVID-19 Using Data Visualization Principles in R	1	16-07-2026		TLM 4	
11.	Case Study: Understanding the Impact of COVID-19 Using Data Visualization Principles in R	1	16-07-2026		TLM4	
12.	Case Study: Understanding the Impact of COVID-19 Using Data Visualization Principles in R	1	17-07-2026		TLM4	
<b>No. of classes required to complete UNIT-I: 12</b>				<b>No. of classes taken:</b>		

#### UNIT-II: Visual Representations

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Creating Visual Representations	1	20-07-2026		TLM 1,2	
14.	Types of Visual Representations- Graphs, Plots, Charts, Maps	1	23-07-2026		TLM 1,2	
15.	visualization reference model	1	23-07-2026		TLM 1,2	
16.	Visual Mapping – Positional Mapping, Color Mapping	1	24-07-2026		TLM 1,2	
17.	Visual Mapping – Size Mapping, Opacity Mapping	1	27-07-2026		TLM 1,2	
18.	visual analytics- Static Visualization (ggplot2), Interactive Charts (plotly)	1	30-07-2026		TLM 1,2	
19.	visual analytics- Interactive Tables (DT)	1	30-07-2026		TLM 1,2	
20.	visual analytics- Geographic Visual Analytics (leaflet)	1	31-07-2026		TLM 1,2	
21.	Design of visualization applications	1	03-08-2026		TLM 1,2	
22.	Design of visualization applications	1	06-08-2026		TLM 1,2	
23.	Case Study: Visual Analytics of	1	06-08-2026		TLM 4	

	Global CO <sub>2</sub> Emissions				
24.	Case Study: Visual Analytics of Global CO <sub>2</sub> Emissions	1	07-08-2026		TLM 4
<b>No. of classes required to complete UNIT-II: 12</b>				<b>No. of classes taken:</b>	

### UNIT-III: Visualization Systems and 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
25.	Classification of visualization systems-By Data Type, By Task	1	10-08-2026		TLM 1,2	
26.	Classification of visualization systems-By Interactivity, By User Control	1	13-08-2026		TLM 1,2	
27.	Classification of visualization systems-By Visual Encoding, By Medium	1	13-08-2026		TLM 1,2	
28.	Interaction and visualization techniques misleading	1	14-08-2026		TLM 1,2	
29.	Visualization of one-dimensional data	1	17-08-2026		TLM 1,2	
30.	Visualization of one-dimensional text and text documents	1	20-08-2026		TLM 1,2	
31.	Visualization of two-dimensional data	1	20-08-2026		TLM 1,2	
32.	Visualization of two-dimensional text and text documents	1	21-08-2026		TLM 1,2	
33.	Visualization of two-dimensional data	1	31-08-2026		TLM 1,2	
34.	Visualization of two-dimensional text and text documents	1	03-09-2026		TLM 1,2	
35.	Case Study: Understanding Visualization Systems and Misleading Visuals Through Multi-dimensional and Text Data in R	1	03-09-2026		TLM 4	
36.	Case Study: Understanding Visualization Systems and Misleading Visuals Through Multi-dimensional and Text Data in R	1	07-09-2026		TLM 4	
<b>No. of classes required to complete UNIT-III: 12</b>				<b>No. of classes taken:</b>		

### UNIT-IV: Visualization of Entities

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Visualization of groups	1	10-09-2026		TLM 1,2	
38.	Visualization of trees	1	11-09-2026		TLM 1,2	
39.	Visualization of graphs	1	11-09-2026		TLM 1,2	
40.	Visualization of clusters	1	17-09-2026		TLM 1,2	
41.	Visualization of networks	1	18-09-2026		TLM 1,2	
42.	Visualization of software	1	21-09-2026		TLM 1,2	
43.	Metaphorical visualization-ggraph/igraph, waffle	1	21-09-2026		TLM 1,2	

44.	Metaphorical visualization-treemap	1	24-09-2026		TLM 1,2	
45.	Metaphorical Visualization-grid/ggimage	1	25-09-2026		TLM 1,2	
46.	Case Study: Metaphorical Visualization of Population Data as a Tree and Icons	1	28-09-2026		TLM 4	
47.	Case Study: Metaphorical Visualization of Population Data as a Tree and Icons	1	28-09-2026		TLM 4	
<b>No. of classes required to complete UNIT-IV: 11</b>				<b>No. of classes taken:</b>		

### UNIT-V: Visualization Trends-GIS Systems, Data Structures Used for Visualization

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
48.	Visualization of volumetric data, vector fields	1	01-10-2026		TLM 1,2	
49.	processes and simulations	1	05-10-2026		TLM 1,2	
50.	Visualization of maps	1	08-10-2026		TLM 1,2	
51.	Visualization of geographic information	1	08-10-2026		TLM 1,2	
52.	GIS systems	1	09-10-2026		TLM 1,2	
53.	collaborative visualizations	1	12-10-2026		TLM 1,2	
54.	Evaluating visualizations	1	15-10-2026		TLM 1,2	
55.	Recent trends in various perception techniques	1	15-10-2026		TLM 1,2	
56.	Recent trends in various visualization techniques	1	16-10-2026		TLM 1,2	
57.	Data structures used in data visualization.	1	26-10-2026		TLM 1,2	
<b>No. of classes required to complete UNIT-V: 12</b>				<b>No. of classes taken:</b>		

### 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
58.	Understanding Data Structures in Data Visualization Using R: A Practical Approach	1	29-10-2026		TLM 4	
59.	Recent Trends in Data Visualization Techniques: An R-Based Exploration	1	30-10-2026		TLM 4	

Teaching Learning Methods			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/Swayam Prabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	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):

<b>PO 1</b>	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	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.
<b>PO 3</b>	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.
<b>PO 4</b>	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.
<b>PO 5</b>	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
<b>PO 6</b>	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
<b>PO 7</b>	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.
<b>PO 8</b>	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to
<b>PO 11</b>	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.
<b>PO 12</b>	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):**

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

<b>Title</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>Head of the Department</b>
<b>Name of the Faculty</b>	<b>Mr. G Rambabu</b>	<b>Mrs. V. Sowjanya</b>	<b>Dr. O Ramadevi</b>	<b>Dr. P. Bhagath</b>
<b>Signature</b>				



R3 Atul Kahate: Object Oriented Analysis & Design, The McGraw – Hill Companies.

R4 Applying UML and Patterns: An introduction to Object Oriented Analysis and Design and Unified Process, Craig Larman, Pearson Education.

## PART-B

### COURSE DELIVERY PLAN (LESSON PLAN)

#### UNIT-I: OOAD Introduction

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.	Structure of Complex Systems	1	30-06-2026		TLM2	
2.	Inherent Complexity of Software	1	01-07-2026		TLM2	
3.	Attributes of Complex System	1	02-07-2026		TLM2	
4.	Organized and Disorganized Complexity	1	03-07-2026		TLM2	
5.	Bringing Order to Chaos	1	07-07-2026		TLM2	
6.	Designing Complex Systems	1	08-07-2026		TLM2	
7.	Case Study : System Architecture	1	10-07-2026		TLM2	
8.	Satellite Based Navigation	1	14-07-2026		TLM2	
<b>No. of classes required to complete UNIT-I: 08</b>				<b>No. of classes taken:</b>		

#### UNIT-II: Introduction to UML

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	Importance of modeling Principles of modeling	1	15-07-2026		TLM2	
10.	Object-oriented modeling Conceptual model of the UML	1	16-07-2026		TLM2	
11.	Architecture	1	17-07-2026		TLM2	
12.	Software Development Life Cycle	1	21-07-2026		TLM2	
13.	Basic Structural Modeling : Classes, Relationships	1	22-07-2026		TLM2	
14.	Common Mechanisms	1	23-07-2026		TLM2	
15.	Diagrams	1	24-07-2026		TLM2	
16.	Case Study : Control System : Traffic Management	1	28-07-2026		TLM2	
<b>No. of classes required to complete UNIT-II: 08</b>				<b>No. of classes taken:</b>		

**UNIT-III: Class & Object Diagrams**

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.	Terms & Concepts	1	29-07-2026		TLM1	
18.	Modeling Techniques for Class & Object Diagrams	1	30-07-2026		TLM1	
19.	Advanced Structural Modeling : Advanced Classes	1	31-07-2026		TLM1	
20.	Advanced Relationships	1	04-08-2026		TLM1	
21.	Interfaces, Types & Roles	1	05-08-2026		TLM1	
22.	Packages	1	06-08-2026		TLM1	
23.	Case Study : AI Cryptanalysis	2	07-08-2026 11-08-2026		TLM1	
24.	Revision of Unit I	2	12-08-2026 13-08-2026		TLM1	
25.	Revision of Unit 2	2	14-08-2026 18-08-2026		TLM1	
26.	Revision of Unit 3 first half	1	19-08-2026		TLM1	
<b>No. of classes required to complete UNIT-III: 13</b>				<b>No. of classes taken:</b>		

**UNIT-IV: Basic Behavioral Modeling-I**

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.	Interactions	1	20-08-2026		TLM1	
28.	Interaction diagrams Use cases	1	21-08-2026		TLM1	
29.	Use Case Diagrams	2	01-09-2026 02-09-2026		TLM1	
30.	Activity Diagrams	2	03-09-2026 08-09-2026		TLM1	
31.	Case Study : Web Application : Vacation Tracking System	2	09-09-2026 10-09-2026		TLM1	
<b>No. of classes required to complete UNIT-IV: 08</b>				<b>No. of classes taken:</b>		

**UNIT-V: Advanced Behavioral Modeling**

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.	Events and Signals	2	11-09-2026 15-09-2026		TLM2		
33.	State Machines	2	16-09-2026 17-09-2026		TLM2		
34.	Processes & Threads	1	18-09-2026		TLM2		
35.	Time & Space	1	22-09-2026		TLM2		
36.	State Chart Diagrams	2	23-09-2026 24-09-2026		TLM2		
37.	Architectural Modeling : Component & Deployment	2	25-09-2026 29-09-2026		TLM2		
38.	Component & Deployment Diagrams	2	30-09-2026 01-10-2026		TLM2		
39.	Case Study : Weather Forecasting	2	06-10-2026 07-10-2026		TLM2		
<b>No. of classes required to complete UNIT-V: 14</b>				<b>No. of classes taken:</b>			

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

### **PART-C**

#### **EVALUATION PROCESS (R20 Regulation):**

<b>Evaluation Task</b>	<b>Marks</b>
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
<b>Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))</b>	<b>M=30</b>
<b>Cumulative Internal Examination (CIE): M</b>	<b>30</b>
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

## PART-D

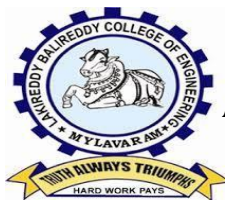
### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design-development of solutions:</b> 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.
<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> 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.
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<b>PO 7</b>	<b>Environment and sustainability:</b> 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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<b>PO 9</b>	<b>Individual and team work:</b> Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	<b>Communication:</b> 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.
<b>PO 11</b>	<b>Project management and finance:</b> 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.
<b>PO 12</b>	<b>Life-long learning:</b> 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):

<b>PSO 1</b>	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
<b>PSO 2</b>	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
<b>PSO 3</b>	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 V Suryanarayana			Dr P Bhagath
Signature				



# LAKIREDDY BALIREDDY 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, NTR DIST., A.P.-521230.

Phone: 08659-222933, Fax: 08659-222931

## **DEPARTMENT OF ARTIFICIAL INTELLIGENCE & DATA SCIENCE** **COURSE HANDOUT**

### PART-A

**Name of Course Instructor:** Mr. K. Lkashmi Prasad, Sr. Assistant Professor

**Course Name & Code** : Sustainable Energy Technologies- 23ME81 **Regulation:** R23

**L-T-P Structure** : 3-0-0 **Credits:** 03

**Program/Sem/Sec** : B.Tech- AI & DS V Sem A/S **A.Y.:** 2026-27

**PREREQUISITE** : Nil

**COURSE EDUCATIONAL OBJECTIVES (CEOs):** To provide the insights on different sustainable energy sources, potential, salient features and utilization of solar, wind, geothermal, ocean thermal energy, bio energy and fuel cell systems.

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

<b>CO 1</b>	Demonstrate the importance, the impact of solar radiation. ( <b>Understanding-L2</b> )
<b>CO 2</b>	Understand the principles of solar PV modules and storage in PV systems. ( <b>Understanding-L2</b> )
<b>CO 3</b>	Discuss solar energy storage systems and their applications. ( <b>Understanding-L2</b> )
<b>CO 4</b>	Describe power extraction from wind and bio-mass. ( <b>Understanding-L2</b> )
<b>CO5</b>	Illustrate the working of geothermal, ocean energy and fuel cells. ( <b>Understanding-L2</b> )

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

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

### TEXT BOOKS:

**T1** Renewable Energy Technologies -Ramesh & Kumar /Narosa

**T2** Solar Energy – Principles of Thermal Collection and Storage/Sukhatme S.P. and J.K.Nayak/TMH

**T3** Non-conventional Energy Source- G.D Roy/Standard Publishers.

### REFERENCE BOOKS:

**R1.** Non-Conventional Energy Resources- Khan B.H/ Tata McGraw Hill, New Delhi, 2006.

**R2.** Non-Conventional Energy - Ashok V Desai /New Age International (P) Ltd

**R3.** Non-conventional Energy Source- G S Sawhney- PHI, New Delhi, 2012

## **PART-B**

### **COURSE DELIVERY PLAN (LESSON PLAN):**

#### **UNIT-I:**

#### **SOLAR RADIATION**

<b>S.No.</b>	<b>Topics to be covered</b>	<b>No. of Classes Required</b>	<b>Tentative Date of Completion</b>	<b>Actual Date of Completion</b>	<b>Teaching Learning Methods</b>	<b>HOD Sign Weekly</b>
1.	Course Outcomes	1	01.07.26		TLM2	
2.	Role and potential of new and renewable sources	1	02.07.26		TLM2	
3.	The solar energy option, Environmental impact of solar power	1	04.07.26		TLM2	
4.	Structure of the Sun, The solar constant	1	08.07.26		TLM2	
5.	Sun-earth relationships	1	09.07.26		TLM2	
6.	Coordinate systems and coordinates of the sun	1	15.07.26		TLM2	
7.	Extraterrestrial and terrestrial solar radiation	1	16.07.26		TLM2	
8.	Solar radiation on tilted surface	1	18.07.26		TLM2	
9.	Instruments for measuring solar radiation and sun shine, Solar radiation data	1	22.07.26		TLM2	
10.	ABL	1	23.07.26		TLM6	
No. of classes required to complete UNIT-I: 10				No. of classes taken:		

#### **UNIT-II:**

#### **SOLAR PV MODULES AND PV SYSTEMS**

<b>S.No.</b>	<b>Topics to be covered</b>	<b>No. of Classes Required</b>	<b>Tentative Date of Completion</b>	<b>Actual Date of Completion</b>	<b>Teaching Learning Methods</b>	<b>HOD Sign Weekly</b>
1.	PV module Circuit Design, Module Structure, Packing Density	1	23.07.26		TLM2	
2.	Interconnections, Mismatch and temperature effects	1	25.07.26		TLM2	
3.	Electrical and Mechanical Insulation, Lifetime of PV modules, Degradation and failure	1	29.07.26		TLM2	
4.	PV module parameters, Efficiency of PV Systems	1	30.07.26		TLM2	
5.	Solar PV Systems	2	05.08.26 06.08.26		TLM2	
6.	Battery Operation, Types of Batteries, Battery parameters, Applications,	2	07.08.26 12.08.26		TLM2	

	Selection of batteries for Solar PV System					
7.	ABL	1	13.08.26		TLM6	
No. of classes required to complete UNIT-II: 09				No. of classes taken:		

### UNIT-III:

#### SOLAR ENERGY COLLECTION, SOLAR ENERGY STORAGE AND APPLICATIONS

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.	Solar Energy Collection: Flat plate and concentrating collectors	1	19.08.26		TLM2	
2.	Classification of concentrating collectors	1	20.08.26		TLM2	
3.	Solar Energy Storage and Applications: Different methods	1	22.08.26		TLM2	
4.	Sensible latent heat and stratified storage, Solar ponds	1	26.08.26		TLM2	
5.	Solar Applications-solar heating cooling technique	1	27.08.26		TLM2	
6.	Solar distillation and drying	1	29.08.26		TLM2	
7.	Solar cookers, Central power tower concept	1	02.09.26		TLM2	
8.	Solar chimney	1	03.09.26		TLM2	
9.	ABL	1	05.09.26		TLM6	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

### UNIT-IV :

#### WIND ENERGY, BIO-MASS

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.	Wind energy: Sources and potential	1	09.09.26		TLM2	
2.	Horizontal and Vertical axis wind mill.	1	10.09.26		TLM2	
3.	Performance characteristics	1	16.09.26		TLM2	
4.	Betz criteria	1	17.09.26		TLM2	
5.	Types of winds, Wind data measurement	1	19.09.26		TLM2	
6.	Bio-mass: Principles of bio-conversion, Anaerobic/aerobic digestion	1	23.09.26		TLM2	
7.	Types of biogas digesters	1	24.09.26		TLM2	
8.	Gas yield, Gasifiers, Applications	1	26.09.26		TLM2	

9.	ABL	1	30.09.26		TLM6	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

**UNIT-V :**

**GEOHERMAL ENERGY, OCEAN ENERGY, FUEL CELLS**

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.	Geothermal Energy: Origin, Applications	1	01.10.26		TLM2	
2.	Types of Geothermal Resources	1	03.10.26		TLM2	
3.	Geothermal power generation	1	07.10.26		TLM2	
4.	Relative merits and demerits	1	08.10.26		TLM2	
5.	Ocean Energy: Ocean Thermal energy	1	14.10.26		TLM2	
6.	Open cycle and closed cycle OTEC plants, Environmental impacts	1	15.10.26		TLM2	
7.	Fuel Cells: Introduction, Applications, Classification,	1	17.10.26		TLM2	
8.	Types of Fuel Cells, Phosphoric Acid fuel cell, Alkaline fuel cell	1	28.10.26		TLM2	
9.	PEM fuel cell, MC fuel cell	1	29.10.26		TLM2	
10.	ABL	1	31.10.26		TLM6	
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

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

**Academic Calendar**

Description	From	To	Weeks
I Phase of Instructions	29.06.26	22.08.26	8
I MID Examinations	24.08.26	29.08.26	1
II Phase of Instructions	31.08.26	17.10.26	7
Dussehra Holidays	19.10.26	24.10.26	1
II Phase of Instructions Contd...	26.10.26	31.10.26	
II MID Examinations	02.11.26	07.11.26	1
Preparation and Practicals	09.11.26	14.11.26	1
Semester End Examinations	16.11.26	28.11.26	2

**PART-C**  
**EVALUATION PROCESS (R23 Regulation):**

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

**PART-D**

**PROGRAMME OUTCOMES (POs):**

<b>PO 1</b>	<b>Engineering knowledge:</b> Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	<b>Problem analysis:</b> Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
<b>PO 3</b>	<b>Design/development of solutions:</b> 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.
<b>PO 4</b>	<b>Conduct investigations of complex problems:</b> 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.
<b>PO 5</b>	<b>Modern tool usage:</b> 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
<b>PO 6</b>	<b>The engineer and society:</b> 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
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	and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
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<b>PO 12</b>	<b>Life-long learning:</b> 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):**

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

**Course Instructor**

Mr. K. Lakshmi  
Prasad

**Course Coordinator**

Dr. K Dilip Kumar

**Module Coordinator**

Dr. K Dilip Kumar

**HOD**

Dr. M B S  
Sreekara Reddy



# 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**

## COURSE HANDOUT

### PART-A

<b>PROGRAM</b>	: B.Tech. V-Sem
<b>ACADEMIC YEAR</b>	: 2026-27
<b>COURSE NAME &amp; CODE</b>	: Data Warehousing and Data Mining Lab (23AD53)
<b>L-T-P STRUCTURE</b>	: 3-0-0
<b>COURSE CREDITS</b>	: 3
<b>COURSE INSTRUCTOR</b>	: Mr. M. Kishore Kumar

**PRE-REQUISITE:** WEKA Tool/Python/R-Tool/Rapid Tool/Oracle Data mining/Data Base Management Systems.

#### **Course Educational Objective:**

The objective of this lab is to Practical exposure on implementation of well-known data mining algorithms and Learning performance evaluation of data mining algorithms in a supervised and an unsupervised setting.

**Course Outcomes (CO):** At the end of this course, the student will be able to:

**CO 1:** Inculcate Conceptual, Logical, and Physical design of Data Warehouses OLAP applications and OLAP deployment

**CO 2:** Design a data warehouse or data mart to present information needed by management in a form that is usable

**CO 3:** Emphasize hands-on experience working with all real data sets

**CO 4:** Test real data sets using popular data mining tools such as WEKA, Python Libraries.

#### **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	2	1									1	2	2	1
CO2	3	2		2									2	2	
CO3	2	3	2	2								2	2	2	1
CO4	2				2								1		

**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

### DATA WAREHOUSING AND DATA MINING LAB SCHEDULE (LESSON PLAN): Section-B

Expt. No	Experiments to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Creation of a Data Warehouse.	1	30/06/2026		TLM8 TLM5	
2	Explore machine learning tool "WEKA"	1	07/07/2026		TLM8 TLM5	
3	Perform data pre-processing tasks and Demonstrate performing association rule mining on data sets	1	14/07/2026		TLM8 TLM5	
4	Demonstrate performing classification on data sets Weka/R	1	21/07/2026		TLM8 TLM5	
5	Demonstrate performing clustering of data sets	1	28/07/2026		TLM8 TLM5	
6	Demonstrate knowledge flow application on data sets into Weka/R	1	04/08/2026		TLM8 TLM5	
7	Demonstrate ZeroR technique on Iris dataset (by using necessary preprocessing technique(s)) and share your observations	1	11/08/2026		TLM8 TLM5	
8	Write a java program to prepare a simulated data set with unique instances.	1	18/08/2026		TLM8 TLM5	
9	Write a Python program to generate frequent item sets / association rules using Apriori algorithm	1	01/09/2026		TLM8 TLM5	
10	Write a program to calculate chi-square value using Python/R. Report your observation.	1	08/09/2026		TLM8 TLM5	
11	Write a program of Naive Bayesian classification using Python/R programming language.	1	15/09/2026		TLM8 TLM5	
12	Implement a Java/R program to perform Apriori algorithm	1	22/09/2026		TLM8 TLM5	
13	Write a R program to cluster your choice of data using simple k-means algorithm using JDK	1	29/09/2026		TLM8 TLM5	
14	Write a program of cluster analysis using simple k-means algorithm Python/R programming language.	1	06/10/2026		TLM8 TLM5	

15	Write a program to compute / display dissimilarity matrix (for your own dataset containing at least four instances with two attributes) using Python.	1	13/10/2026		TLM8 TLM5
16	Visualize the datasets using matplotlib in python/R.(Histogram, Box plot, Bar chart, Pie chart etc.,)	1	13/10/2026		TLM8 TLM5
17	Internal Lab	1	27/10/2026		

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

### PART-C

#### EVALUATION PROCESS (R20 Regulations):

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

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

Parameter	Marks
Day to Day work	10
Record	10
Internal Test	10
Total	30

**(b) 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	20
Experimentation/Program execution	30
Observations/Calculations/Validation	
Result/Inference	20
Viva voce	
Total	70

### PART-D

#### PROGRAMME OUTCOMES (POs):

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#### PROGRAMME SPECIFIC OUTCOMES (PSOs):

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<b>PSO 3</b>	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values.

Course Instructor	Course Coordinator	Module Coordinator	HOD
<b>Mr. M. Kishore Kumar</b>	<b>Dr. Ch. Rajendra Babu</b>	<b>Dr. V. Surya Narayana</b>	<b>Dr. P. Bhagath</b>



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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

## COURSE HANDOUT

### PART-A

**Name of Course Instructor:** Mr. G Rambabu/Mrs V. Sowjanya/Mr. V Chandra Kumar  
**Course Name & Code** : DATA VISUALIZATION Lab (23AD54)  
**L-T-P Structure** : 0-0-3 **Credits:** 1.5  
**Program/Sem/Sec** : III B.Tech V Sem AI & DS - A **A.Y.:** 2026-26

**PRE-REQUISITE:** R Tool, Engineering Graphics

#### **COURSE EDUCATIONAL OBJECTIVES (CEOs):**

1. To visualize the different datasets using histograms, line charts.
2. To understand the use of bar charts and box plots.
3. To understand Scatter plots, mosaic plots
4. To understand different Map visualizations
5. To learn advanced graphs such as correlogram, heatmap and 3D graphs.

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

<b>CO 1</b>	Apply different visualization techniques like plots and graphs in R on different datasets ( <b>Apply-L3</b> )
<b>CO 2</b>	Apply different Map visualizations in R ( <b>Apply-L3</b> )
<b>CO 3</b>	Develop advanced graphs such as correlogram, heatmap and 3D graphs in R ( <b>Apply-L3</b> )
<b>CO 4</b>	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
<b>CO1</b>	-	2	2	-	3	-	-	-	-	-	-	-	-	2	-
<b>CO2</b>	-	2	2	-	3	-	-	-	-	-	-	-	2	2	-
<b>CO3</b>	-	2	2	-	3	-	-	-	-	-	-	-	2	2	-
<b>CO4</b>	-	-	-	-	-	-	-	2	2	-	-	-	-	-	2

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

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## 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	R Programming Basics	3	01-07-26		TLM4	
2	R Programming Basics	3	08-07-26		TLM4	
3	Week-1 a) Load VADeaths(Death Rates in Virginia) dataset in R and visualize the data using different histograms. 2 b) Load air quality dataset in R and visualize La Guardia Airport's daily maximum temperature using histogram.	3	15-07-26		TLM4	
4	Week-2 Load AirPassengers dataset in R and visualize the data using line chart that shows increase in air passengers over given time period.	3	22-07-26		TLM4	
5	Week-3 a) Load iris dataset in R, visualize the data using different Bar Charts and also demonstrate the use of stacked plots. b)Load air quality dataset in R and visualize ozone concentration in air.	3	29-07-26		TLM4	
6	Week-4 a) Load iris dataset in R, visualize the data using different Box plots including group by option and also use color palette to represent species. b) Load air quality dataset in R and visualize air quality parameters using box plots.	3	05-08-26		TLM4	
7	Week-5 Visualize iris dataset using simple scatter, multivariate scatter plot and also visualize scatter plot matrix to visualize multiple variables across each other.	3	12-08-26		TLM4	
8	Week-6 Load diamonds dataset in R and visualize the structure in datasets with large data points using hexagon binning and also add color palette	3	19-08-26		TLM4	
9	Week-7 Load HairEyeColor dataset in R and plot categorical data using mosaic plot.	3	02-09-26		TLM4	
10	Week-8 Load mtcars dataset in R and visualize data using heat map.	3	09-09-26		TLM4	
11	Week-9 Install leaflet library in R and perform different map visualizations. Week-12 Install maps library in R and draw different map visualizations.	3	16-09-26		TLM4	
12	Week-10 Visualize iris dataset using 3d graphs such as scatter3d, cloud, xypplot.	3	23-09-26		TLM4	

13	Week-11 Make use of correlogram to visualize data in correlation matrices for iris dataset.	3	14-10-26		TLM4	
14	Internal Exam	3	21-10-26		TLM4	

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

## PART-C

### EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
<b>Continuous Internal Assessment</b>	<b>30</b>
Procedure	20
Execution & Results	30
Viva-voce	20
<b>Semester End Examination (SEE)</b>	<b>70</b>
<b>Total Marks = CIE + SEE</b>	<b>100</b>

## PART-D

### PROGRAMME OUTCOMES (POs):

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<b>Title</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>Head of the Department</b>
<b>Name of the Faculty</b>	<b>Mr. G Rambabu</b>	<b>Mrs. V. Sowjanya</b>	<b>Dr. O Ramadevi</b>	<b>Dr. P. Bhagath</b>
<b>Signature</b>				



# 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. S. V. V. D. JAGADEESH, Mr. J NAGARAJU, Dr. CH. RAJENDRA BABU

Course Name & Code : FULL STACK DEVELOPMENT-II (23CSS4)

L-T-P Structure : 0-1-2-2

Credits: 2

Program/Sem/Sec :III B.Tech /V Sem /AI & DS - A

A.Y.: 2026-27

**PREREQUISITE:** Object oriented programming, Full stack development-I

### **COURSE EDUCATIONAL OBJECTIVES (CEOs):**

The objective of this course is to equip students with hands-on skills in developing full stack web applications using Java, Node.js, and React. It focuses on building backend services using JDBC, Servlets, and Express.js, along with frontend development using React.js. Students will learn to integrate databases like MySQL and MongoDB for real-time data handling. The course emphasizes applying MVC architecture, REST APIs, and deployment practices for complete web solutions.

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

CO1	Apply JDBC and Servlet technologies to develop web applications that interact with relational databases. ( <b>Apply-L3</b> )
CO2	Apply the MVC architecture using JSP, Servlets, and JavaBeans to design structured and maintainable web applications. ( <b>Apply-L3</b> )
CO3	Apply Node.js and Express.js to create RESTful services and perform backend operations with MongoDB. ( <b>Apply-L3</b> )
CO4	Apply React.js to develop dynamic user interfaces and integrate them with backend APIs for full-stack web solutions. ( <b>Apply-L4</b> )

**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	-	3	-	-	-	-	-	-	2	2	2	3
CO2	3	2	3	-	3	-	-	-	-	-	-	2	3	3	2
CO3	3	2	3	-	3	-	-	-	-	-	-	2	2	3	2
CO4	3	2	3	-	3	-	-	-	-	-	-	2	2	3	2
			1 - Low			2 - Medium			3 - High						

### **TEXTBOOKS:**

- T1** "Head First Servlets and JSP" By: Bryan Basham, Kathy Sierra, Bert Bates Publisher: O'Reilly Media.
- T2** "Learning Node.js Development" By: Andrew Mead Publisher: Packt Publishing.
- T3** "MongoDB: The Definitive Guide" By: Kristina Chodorow Publisher: O'Reilly Media
- T4** "Learning React: Modern Patterns for Developing React Apps" By: Alex Banks and Eve Porcello Publisher: O'Reilly Media

**e-Resources:**

1. OracleJavaDocumentation(JDBC&Servlets)  
<https://docs.oracle.com/javase/tutorial/jdbc/>  
<https://docs.oracle.com/javaee/7/tutorial/servlets.htm>
2. MozillaDeveloperNetwork(HTML,JS,HTTP)  
<https://developer.mozilla.org>
3. Node.jsOfficialDocumentation  
<https://nodejs.org/en/docs>
4. Express.jsGuide  
<https://expressjs.com>
5. MongoDBDocumentation  
<https://www.mongodb.com/docs/>
6. React Official Docs  
<https://reactjs.org>
7. W3Schools Tutorials (JSP, JavaScript, Node.js)  
<https://www.w3schools.com>
8. Tutorialspoint(FullStacktopics)  
<https://www.tutorialspoint.com>

**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	Teaching Learning Methods	HOD Sign Weekly
1.	CYCLE-1 (SERVLETS)	3	18-07-2026		TLM 4	
2.	CYCLE-1 (SERVLETS)	3	25-07-2026		TLM 4	
3.	CYCLE-1 (JDBC)	3	01-08-2026		TLM 4	
4.	CYCLE-2 (JSP & Java Beans)	3	08-08-2026		TLM 4	
5.	CYCLE-2 (JSP and MVC)	3	22-08-2026		TLM 4	
6.	Start of Mini Project	3	29-08-2026		TLM 4	
7.	CYCLE-3 (Node.js)	3	05-09-2026		TLM 4	
8.	CYCLE-3 (Node.js and Express.js)	3	12-09-2026		TLM 4	
9.	CYCLE-3 (Node.js and Express.js)	3	19-09-2026		TLM 4	
10.	CYCLE-4 (MongoDB)	3	26-09-2026		TLM 4	
11.	CYCLE-4 (MongoDB and Express.js)	3	03-10-2026		TLM 4	
12.	CYCLE-5 (React.js)	3	10-10-2026		TLM4	
13.	CYCLE-5 (React.js)	3	17-10-2026		TLM4	
14.	Mini Project Finalization	3	31-10-2026		TLM5/TLM6	
15.	Internal Assessment	3	07-11-2026		TLM4	

## PART-C

### EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Day to Day Work:	15
Internal Test	15
<b>Continuous Internal Assessment</b>	<b>30</b>
Procedure	20
Execution & Results	30
Viva-voce	20
<b>Semester End Examination (SEE)</b>	<b>70</b>
Total Marks = CIE + SEE	100

## PART-D

### PROGRAMME OUTCOMES (POs):

<b>PO 1</b>	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
<b>PO 2</b>	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.
<b>PO 3</b>	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.
<b>PO 4</b>	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.
<b>PO 5</b>	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
<b>PO 6</b>	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
<b>PO 7</b>	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.
<b>PO 8</b>	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
<b>PO 9</b>	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
<b>PO 10</b>	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to
<b>PO 11</b>	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.
<b>PO 12</b>	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):**

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

<b>Title</b>	<b>Course Instructor</b>	<b>Course Coordinator</b>	<b>Module Coordinator</b>	<b>Head of the Department</b>
<b>Name of the Faculty</b>	<b>Mr. S.V.V.D.Jagadeesh</b>	<b>Dr. K. Devi Priya</b>	<b>Dr. B. Phani Krishna</b>	<b>Dr. P. Bhagath</b>
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**DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE**

## COURSE HANDOUT

### PART-A

Name of Course Instructor	:Dr. B. Phani Krishna, Mr. K. Sudhakar		
Course Name & Code	:User Interface Design Using Flutter (23IT53)		
L-T-P Structure	:3-0-0	Credits:	3
Program/Sem/Sec	: B.Tech /V Sem /AI & DS – A&B	A.Y.:	2026-27

#### Course Objectives: -

- Learn to Implement Flutter Widgets and Layouts
- Understand Responsive UI Design and with Navigation in Flutter
- Knowledge on Widgets and customize widgets for specific UI elements, Themes
- Understand to include animation apart from fetching data

#### Course Educational Objectives (CEOs):

1. Design, develop, and deploy mobile and web applications using Flutter.
2. Create intuitive user experiences that function flawlessly across diverse screen sizes, devices, and platforms.
3. Implement modular widget designs, adapting efficiently to evolving cross-platform technologies and industry best practices.

**Course Outcomes:** - At the end of this course, the student will be able to

**CO1:** Apply Flutter and Dart fundamentals to design and develop interactive user interfaces.

**(Apply-L3)**

**CO2:** Implement UI layouts, navigation, state management, and responsive design principles for mobile applications. **(Apply-L3)**

**CO3:** Integrate animations, API data fetching, form validation, and debugging techniques to enhance application performance and usability. **(Apply-L3)**

**CO4:** Improve individual / teamwork skills, communication & report writing skills with ethical values. **(Apply -L3)**

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

CO/PO/PSO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	1	2	-	3	-	-	-	1	1	-	2	2	1	2
CO2	3	2	3	1	3	1	-	-	1	2	-	3	2	2	3
CO3	3	2	3	1	3	1	-	-	2	2	-	2	3	2	3
CO4	3	2	3	2	3	-	-	-	2	2	-	3	3	2	3

**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	Topic Name	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Flutter & Dart Basics: SDK Installation & Dart Language Fundamentals (Exp 1a, 1b)	1	03-07-2026 (Fri)		TLM2, TLM4, TLM5	
2	Core Widgets & Layouts: Explore Text, Image, Container; Implement Row, Column, Stack (Exp 2a, 2b)	1	10-07-2026 (Fri)		TLM2, TLM4	
3	Responsive UI Design: Adapting to screen sizes, Media Queries & Breakpoints (Exp 3a, 3b)	1	17-07-2026 (Fri)		TLM1, TLM2, TLM4	
4	App Navigation: Setting up navigation with Navigator & Named Routes (Exp 4a, 4b)	1	24-07-2026 (Fri)		TLM1, TLM2, TLM4	
5	Stateful vs. Stateless Widgets: Understanding their differences and use cases (Exp 5a)	1	31-07-2026 (Fri)		TLM1, TLM2, TLM5	
6	Local State Management: Implementing state using setState() (Exp 5b Part 1)	1	07-08-2026 (Fri)		TLM2, TLM4	
7	External State	1	14-08-2026		TLM2,	

	Management: Introduction to Provider (Exp 5b Part 2)		(Fri)		TLM4, TLM5	
<b>8</b>	Custom Widgets & Theming: Creating reusable custom widgets and applying themes/styles (Exp 6a, 6b)	1	21-08-2026 (Fri)		TLM2, TLM4	
<b>9</b>	Form Design & Validation: Designing forms with input fields, validation, and error handling (Exp 7a, 7b)	1	04-09-2026 (Fri)		TLM2, TLM4	
<b>10</b>	List Widgets & Interaction: Creating scrollable lists, adding items, displaying selections (Exp 8a, 8b)	1	11-09-2026 (Fri)		TLM2, TLM4	
<b>11</b>	UI Animations: Introduction to Flutter's animation framework, basic fade/slide animations (Exp 9a, 9b)	1	18-09-2026 (Fri)		TLM1, TLM2, TLM4	
<b>12</b>	API Integration - Part 1: Fetching data from a REST API (Exp 10a)	1	25-09-2026 (Fri)		TLM1, TLM2, TLM4	
<b>13</b>	API Integration - Part 2: Displaying fetched data in the UI (Exp 10b)	1	09-10-2026 (Fri)		TLM2, TLM4, TLM6	
<b>14</b>	Project Lab / Review Session 1: Hands-on practice, Q&A, and troubleshooting on combined topics	1	16-10-2026 (Fri)		TLM3, TLM4, TLM6	
<b>15</b>	Project Lab / Review Session 2: Consolidated practice, mini-project work, final Q&A	1	30-10-2026 (Fri)		TLM3, TLM4, TLM6	

<b>Teaching Learning Methods</b>			
<b>TLM1</b>	Chalk and Talk	<b>TLM4</b>	Demonstration (Lab/Field Visit)
<b>TLM2</b>	PPT	<b>TLM5</b>	ICT (NPTEL/SwayamPrabha/MOOCs)
<b>TLM3</b>	Tutorial	<b>TLM6</b>	Group Discussion/Project

## PART-C

### Evaluation PROCESS (R23Regulation):

Evaluation Task	Marks
Day to Day Work, Record:	15
Internal Test	15
<b>Continuous Internal Assessment</b>	<b>30</b>
Procedure	20
Execution Results	30
Viva-voce	20
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