LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING, (AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
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 DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

FRESHMAN ENGINEERING DEPARTMENT
COURSE HANDOUT

PART-A

PROGRAM :II B. Tech., IV-Sem., ASE
ACADEMIC YEAR : 2023-24
COURSE NAME & CODE : PROBABILITY AND STATISTICS
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : Dr. K.R. Kavitha
COURSE COORDINATOR : Mr. M. Rami Reddy
PRE-REQUISITES : None

COURSE EDUCATIONAL OBJECTIVES (CEO): The objective of this course is to provide students with the foundations and applications of probabilistic and statistical methods mainly used in varied applications in engineering and science.

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

CO1	Understand various probabilistic situations using the laws of probability and Random variables.	**Understand - L2**
CO2	Apply probability distributions like Binomial, Poisson, Normal and Exponential distributions in solving engineering problems.	**Apply - L3**
CO3	Calculate the standard error of sampling distribution and confidence intervals for parameters like mean and proportion based on sample data.	**Apply - L3**
CO4	Analyze the data scientifically with the appropriate statistical methodologies to apply the suitable test of hypothesis.	**Analyze - L4**
CO5	Construct the regression lines to predict the dependent variables and calculate the Correlation Coefficient for a bivariate statistical data.	**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	1	2	-	-	-	-	-	-	-	2	-	-	-
CO2	3	2	2	3	-	-	-	-	-	-	-	2	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	2	-	-	-
CO4	3	3	3	3	-	-	-	-	-	-	-	2	-	-	-
CO5	3	2	2	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).

BOS APPROVED TEXT BOOKS:

T1 Jay L.Devore "Probability and Statistics for engineering and the sciences." , 8th edition, Cengage Learning india, 2012
T2 S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 11thEdition, Sultan Chand and sons, New Delhi,2014.

BOS APPROVED REFERENCE BOOKS:

R1 Miller & Freund's "Probability and Statistics for Engineers",8th edition. PHI, New Delhi,2011.
R2 B.V. Ramana, "Higher Engineering Mathematics", 1st Edition, TMH, New Delhi, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Probability and Random Variables

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 class, course outcomes	1	02-01-24		TLM1	
2.	Basic concepts of probability	1	03-01-24		TLM1	
3.	Problems on basic probability	1	04-01-24		TLM1	
4.	Axioms, Addition theorem, Problems	1	05-01-24		TLM1	
5.	Multiplication theorem, examples	1	08-01-24		TLM1	
6.	Independent events, theorems	1	09-01-24		TLM1	
7.	Problems	1	10-01-24		TLM1	
8.	Results on independent events	1	11-01-24		TLM1	
9.	Baye's theorem,	1	18-01-24		TLM1	
10.	Problems on Baye's theorem	1	19-01-24		TLM1	
11.	Random variables	1	22-01-24		TLM1	
12.	Random variables, Expectations	1	23-01-24		TLM1	
13.	Problems	1	24-01-24		TLM1	
14.	Probability Mass function, examples	1	25-01-24		TLM1	
15.	Probability Density Function	1	29-01-24		TLM1	
16.	Tutorial 1	1	31-01-24		TLM3	
No. of classes required to complete UNIT-I: 17				No. of classes taken:		

UNIT-II: Probability Distributions

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.	Binomial Distribution- mean & variance	1	30-01-24		TLM1	
2.	Problems on Binomial distribution	1	01-02-24		TLM1	
3.	Problems on Binomial distribution	1	02-02-24		TLM1	
4.	Fitting of binomial distribution	1	05-02-24		TLM1	
5.	Poisson distribution, mean and variance	1	06-02-24		TLM1	
6.	Problems	1	07-02-24		TLM1	
7.	Fitting of Poisson distribution	1	08-02-24		TLM1	
8.	Normal distribution: mean &variance	1	09-02-24		TLM1	
9.	Problems on Normal Distribution	1	12-02-24		TLM1	
10.	Applications of Normal Distribution	1	13-02-24		TLM1	
11.	Problems	1	14-02-24		TLM1	
12.	Exponential distribution, examples	1	15-02-24		TLM1	
13.	Tutorial 2	1	21-02-24		TLM3	
No. of classes required to complete UNIT-II: 13				No. of classes taken:		

UNIT-III: Sampling distribution and Estimation

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.	Sampling distribution ,definitions	1	16-02-24		TLM1	
2.	Types of Sampling	1	19-02-24		TLM2	
3.	Sampling distribution of mean, variance	1	20-02-24		TLM1	
4.	Central limit theorem, Examples	1	22-02-24		TLM1	
5.	Problems on Central Limit Theorem	1	23-02-24		TLM1	
6.	**Mid-I examinations**		26-02-24 to 02-03-24			
7.	Problems on Central Limit Theorem	1	04-02-24		TLM1	
8.	Point and interval estimation	1	05-03-24		TLM1	
9.	Problems	1	06-03-24		TLM1	
10.	Confidence Interval of mean (n>30)	1	07-03-24		TLM1	
11.	Confidence Interval for proportion	1	11-03-24		TLM1	

12.	Confidence Interval for mean (n<30)	1	12-03-24		TLM1	
13.	Tutorial 3	1	13-03-24		TLM3	
14.	Practice problems	1	14-03-24		TLM1	
No. of classes required to complete UNIT-III: 13				No. of classes taken:		

UNIT-IV: Tests of Hypothesis

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.	Testing of Hypothesis , definitions	1	15-03-24		TLM1	
2.	Z-test for single mean	1	18-03-24		TLM1	
3.	Z-test for difference of means	1	19-03-24		TLM1	
4.	Practice problems	1	20-03-24		TLM1	
5.	Z-test for single Proportion	1	21-03-24		TLM1	
6.	Z-test for difference of Proportions	1	22-03-24		TLM1	
7.	t-test for single mean	1	26-03-24		TLM1	
8.	Practice problems	1	27-03-24		TLM1	
9.	t-test for difference of means	1	28-03-24		TLM1	
10.	Paired t-test	1	01-04-24		TLM1	
11.	F-test for variances	1	02-04-24		TLM1	
12.	Practice problems	1	03-04-24		TLM1	
13.	χ^2-test for goodness of fit	1	04-04-24		TLM1	
14.	χ^2-test for independence of attributes	1	08-04-24		TLM1	
15.	Tutorial 4	1	10-04-24		TLM3	
No. of classes required to complete UNIT-IV: 15				No. of classes taken:		

UNIT-V: Correlation and Regression

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.	Simple Bi-variate Correlation	1	15-04-24		TLM1	
2.	Problems on Pearson's Correlation	1	16-04-24		TLM1	
3.	Regression lines	1	18-04-24		TLM1	
4.	Problems on Regression lines	1	19-04-24		TLM1	
5.	Properties of Regression coefficients	1	22-04-24		TLM1	
6.	Problems on rank Correlation	1	23-04-24		TLM1	
7.	Tutorial 5	1	24-04-24		TLM3	
8.	Problems on repeated ranks	1	25-04-24		TLM1	
9.	Revision	1	26-04-24		TLM1	
No. of classes required to complete UNIT-V:09				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R20 Regulations):

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

Program Outcomes (POs):

PO1 - Engineering Knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2 - 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.
PO3 - 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.
PO4 - 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.
PO5 - 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.
PO6 - 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.
PO7 - 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.
PO8 - Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 - Individual and Team Work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 - 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.
PO11 - Project Management and Finance	Demonstrate knowledge and understanding of the ring 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 - 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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr. K.R. Kavitha)	(M.Rami Reddy)	(Dr.A.Rami Reddy)	(Dr.A.Rami Reddy)

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. G V SURYA NARAYANA
Course Name & Code **: 20AE05-AEROSPACE MATERIALS AND MANUFACTURING**
L-T-P Structure **:** 0-0-3 **Credits:** 3
Program/Sem/Sec : B.Tech-IV SEM **A.Y.:** 2023-24

PREREQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of this course are to acquire knowledge on structure of metals and alloys, understand the concept of alloys and equilibrium diagrams and to learn primary manufacturing processes, working of basic machines and various operations to be performed and also about conventional and unconventional machining processes.

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

CO1	Estimate the properties of the metals and alloys based on structures. **(Understand-L2)**
CO2	Classify, construct and analyze equilibrium diagrams, various ferrous, non-ferrous metals and alloys. **(Understand-L2)**
CO3	Acquire knowledge of the basic aspects of casting process. **(Understand-L2)**
CO4	Know the various basic concepts of welding process, metal forming process and sheet metal operations in the manufacturing of products. **(Understand-L2)**
CO5	Know different conventional and unconventional machining processes while manufacturing a product. **(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
CO1	3	-	2	2	-	-	-	-	-	-	-	1	3	3
CO2	3	-	2	2	-	-	-	-	-	-	-	1	3	3
CO3	3	-	2	2	-	-	-	-	-	-	-	1	3	3
CO4	3	-	2	2	-	-	-	-	-	-	-	1	3	3
CO5	3	-	2	2	-	-	-	-	-	-	-	1	3	3
1 - Low						**2** –Medium						**3** - High		

TEXTBOOKS:

T1 V.D.Kotgire, S.V.Kotgire, Material Science and Metallurgy, Everest Publishing House, 24th Edition, 2008

T2 Rao. P. N, Manufacturing Technology, Volume 1 and 2 Tata McGraw-Hill, 2013.

REFERENCE BOOKS:

R1 Ghosh. A, Malik. A. K, Manufacturing Science, Second Edition, East West Publisher, 2010.

R2 Kalpakjain. S, Schmid. S. R, Manufacturing Processes for Engineering Materials, 6th Edition, Pearson Education, 2017

R3 Richard A.Flinn, Paul K.Trojan, Engineering Materials and Their Applications, Jaico Publishing House, 4thEdition, 1999.

R4 William and callister, Materials Science and engineering, Wiley India private Ltd., 2011.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: STRUCTURE OF METALS:

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 METALS:** Crystal Structures-	01	01-01-2024		TLM1, TLM2	
2.	Body-centered cubic,	01	03-01-2024		TLM1, TLM2	
3.	Face centered cubic, closed packed	01	04-01-2024		TLM1, TLM2	
4.	hexagonal,	01	05-01-2024		TLM1, TLM2	
5.	Mechanism of grain and grain boundaries,	01	08-01-2024		TLM1, TLM2	
6.	Effect of grain boundaries on the properties of metal/alloys,	01	10-01-2024		TLM1	
7.	Determination of grain size.	01	11-01-2024		TLM1	
8.	Solid solutions- Interstitial Solid Solutions and	01	12-01-2024		TLM1, TLM2	
9.	Substitution Solid Solution,	01	18-01-2024		TLM1	
10.	Hume Rothery rules. Assignment-1	01	19-01-2024		TLM1, TLM2	
No. of classes required to complete UNIT-I: 10				**No. of classes taken:**		

UNIT-II: EQUILIBRIUM DIAGRAMS AND TRANSFORMATIONS, STEEL, CAST IRON AND NON-FERROUS METALS AND ALLOYS:

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.	**EQUILIBRIUM DIAGRAMS AND TRANSFORMATIONS:** Classification of equilibrium diagrams-	01	22-01-2024		TLM1	
12.	isomorphous, eutectic equilibrium diagrams.	01	24-01-2024		TLM1, TLM2	
13.	partial eutectic equilibrium diagrams. Lever rule	01	25-01-2024		TLM1	
14.	Study of Cu-Ni equilibrium diagram	01	29-01-2024		TLM1, TLM2	
15.	Iron-Iron carbide equilibrium diagram	01	31-01-2024		TLM1	
16.	**STEEL:** Classification of steels, structure,	01	01-02-2024		TLM1, TLM2	
17.	properties and applications of plain carbon steel	01	01-02-2024		TLM1, TLM2	
18.	low carbon steel	01	02-02-2024		TLM1, TLM2	
19.	medium carbon steel		05-02-2024		TLM1, TLM2	
20.	high carbon steel.	01	07-02-2024		TLM1, TLM2	
21.	**CAST IRONS:** structure, properties and applications of white cast iron,	01	08-02-2024		TLM1, TLM2	
22.	malleable cast iron, grey cast iron,	01	09-02-2024		TLM1, TLM2	
23.	spheroidal graphite cast iron	01	12-02-2024		TLM1, TLM2	
24.	**NON-FERROUS METALS AND ALLOYS:** structure,	01	14-02-2024		TLM1, TLM2	
25.	properties and applications of copper and its alloys,	01	15-02-2024		TLM1, TLM2	
26.	Aluminium and its alloys. Assignment-I	01	16-02-2024		TLM1	
No. of classes required to complete UNIT-II: 16				**No. of classes taken:**		

UNIT-III: INTRODUCTION TO MANUFACTURING AND CASTING

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.	**INTRODUCTION TO MANUFACTURING AND CASTING**: Classification of manufacturing processes	01	19-02-2024		TLM1	
28.	Engineering materials, Steps involved in making a casting	01	21-02-2024		TLM1	
29.	Advantages of castings and its applications	01	22-02-2024		TLM1	
30.	Types of patterns, pattern allowances.	01	23-02-2024		TLM1	
MID EXAM						
31.	principles of Gating ratio, types of raisers	01	04-03-2024		TLM1	
32.	**Special casting processes**: Centrifugal casting, Die casting	01	06-03-2024		TLM1, TLM2	
33.	Investment casting, Assignment-II	01	07-03-2024		TLM1, TLM2	
No. of classes required to complete UNIT-III: 09				**No. of classes taken:**		

UNIT-IV: WELDING, METAL FORMING PROCESSES, EXTRUSION OF METALS:

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.	**WELDING:** Classification of Welding Process-	01	11-03-2024		TLM1, TLM2	
35.	Types of Welds- Welded Joints,	01	13-03-2024		TLM1	
36.	Principle and Applications- Gas Welding	01	14-03-2024		TLM1	
37.	Arc Welding	01	15-03-2024		TLM1, TLM2	
38.	Friction Welding,	01	18-03-2024		TLM1, TLM2	
39.	Soldering and Brazing.	01	20-03-2024		TLM1, TLM2	
40.	**METAL FORMING PROCESSES:** Types of Rolling Mills and Products;	01	21-03-2024		TLM1	
41.	Principles of Forging	01	22-03-2024		TLM1	
42.	Types of Forging-Smith Forging,	01	27-03-2024		TLM1, TLM2	
43.	Drop Forging	01	28-03-2024		TLM1, TLM2	

44.	**EXTRUSION OF METALS:** Hot Extrusion, Cold Extrusion	01	01-04-2024		TLM1, TLM2	
45.	Forward Extrusion, Backward Extrusion	01	03-04-2024		TLM1, TLM2	
46.	Impact Extrusion, Hydrostatic Extrusion. Assignment-II	01	04-04-2024		TLM1, TLM2	
No. of classes required to complete UNIT-IV: 14				**No. of classes taken:**		

UNIT-V: MACHINING PROCESSES, SHAPING, PLANNING, MILLING AND DRILLING MACHINES (UNCONVENTIONAL MACHINING PROCESSES), AND INTRODUCTION TO UNCONVENTIONAL MACHINING PROCESSES:

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.	**MACHINING PROCESSES**: Tool Geometry	01	05-04-2024		TLM1	
48.	Cutting Tool & Tool Wear	01	08-04-2024		TLM1	
49.	Cutting Materials; Cutting Fluids;	01	10-04-2024		TLM1	
50.	Introduction and Working Principle of Lathe and Operations	01	11-04-2024		TLM1, TLM2	
51.	Principles of Working, Principal Parts, Specifications, Classification, Comparison and Operations Performed: SHAPING	01	12-04-2024		TLM1, TLM2	
52.	Planning, Milling	01	15-04-2024		TLM1, TLM2	
53.	Drilling Machines	01	17-04-2024		TLM1, TLM2	
54.	**INTRODUCTION TO UNCONVENTIONAL MACHINING PROCESSES**: Classification of Unconventional Machining Processes. Abrasive Jet Machining	01	18-04-2024		TLM1, TLM2	
55.	Ultrasonic Machining	01	19-04-2024		TLM1, TLM2	
56.	Laser Beam Machining, Assignment II	01	22-04-2024		TLM1, TLM2	
No. of classes required to complete UNIT-V: 11				**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.	Advanced Additive Manufacturing Technology	01	24-04-2024		TLM2	
2.	Advance welding process	01	25-04-2024		TLM2	
3.	Advanced material removing process (CNC & NC Program)	01	26-04-2024		TLM2	
No. of classes required to complete for advanced topics		**03**				

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures, and Flight Dynamics in Aerospace vehicle design.
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations.

Title	**Course Instructor**	**Module Coordinator**	**Head of the Department**
Signature			
Name of the Faculty	Mr. G V SURYA NARAYANA	Mr. I DAKSHINA MURTHY	Dr. P. LOVARAJU

LAKKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF AEROSPACE ENGINEERING
(Autonomous & Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi, NAAC Accredited, Certified by ISO 9001:2015
L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT
PART-A

PROGRAM : B.Tech., IV-Sem., ASE

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : **Aerodynamics-20AE06**

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Dr. P. Lovaraju**

PRE-REQUISITE: Nil

Course Educational Objective: To learn the theoretical methods to solve the potential flow problems, potential flow theory to solve for airfoil characteristics, the finite wing theory and properties of viscous flows and boundary layer development over flat plate.

Course Outcomes: At the end of the semester, the student will be able to

CO1: Apply Laplace equation for obtaining 2D and axisymmetric solutions. (Apply-L3)
CO2: Apply conformal transformation to from aerodynamic shapes. (Apply-L3)
CO3: Apply potential flow theory to solve for airfoil characteristics. (Apply-L3)
CO4: Apply the Prandtl's lifting line theory to predict finite wing properties. (Apply-L3)
CO5: Analyze the effect of boundary layer on flow over objects. (Analyze-L4)

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

Course Code	Cos	Program Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
20AE06	CO1	3	1	2	1	-	-	1	-	-	-	-	-	3	2
	CO2	3	3	3	3	-	-	1	-	-	-	-	-	3	3
	CO3	3	2	3	3	-	-	1	-	-	-	-	-	3	3
	CO4	3	3	3	2	-	-	1	-	-	-	-	-	3	3
	CO5	3	3	2	2	-	-	1	-	-	-	-	-	3	2
1 = Slight (Low)		**2 = Moderate (Medium)**									**3-Substantial(High)**				

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

TEXT BOOKS:

T1 Anderson, J.D., Fundamentals of Aerodynamics", Sixth Edition, McGraw-Hill Book Co., New York, 2017

T2 Rathakrishnan. E, Theoretical Aerodynamics, Wiley, 2013

REFERENCE BOOKS:

R1 Houghton. E. L., Carpenter P. W, Collicott. C. H, Valentine. D. T, Aerodynamics for Engineering students, Seventh Edition, Elseveir, 2017

R2 Milne-Thomson. L. H., Theoretical aerodynamics, Courier Corporation, 2012.

R3 Clancy. J. L, Aerodynamics, Sterling Book House, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: POTENTIAL FLOW

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.	Overview of the course and course outcomes	1	1-01-2022		TLM1	
2.	Review of Fluid Mechanics and Introduction to the Potential flow	1	2-01-2024		TLM1	
3.	Basic Flows-Uniform parallel flow, Source and Sink Flows	2	3-01-2024 5-01-2024		TLM1	
4.	Source and Sink Pair-Doublet, Simple vortex	1	6-01-2024		TLM1	
5.	Tutorial	1	8-01-2024		TLM3	
6.	Combination of uniform flow and Source-Flow past half body	1	9-01-2024		TLM1	
7.	Rankine oval	1	10-1-2024		TLM1	
8.	Flow over circular Cylinder without circulation	2	19-01-2024 20-01-2024		TLM1	
9.	Flow over circular Cylinder with circulation	2	22-01-2024 23-01-2024		TLM1	
10.	Kutta-Joukowsky Theorem	1	24-01-2024		TLM1	
	Tutorial	1	27-01-2024		TLM3	
No. of classes required to complete UNIT-I		14		**No. of classes taken:**		

UNIT-II: CONFORMAL TRANSFORMATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
12	Conformal Mapping Introduction, Basic Principles, Methods for Performing Transformation	1	29-01-2024		TLM1	
13	Examples of Simple Transformation	2	30-01-2024 31-01-2024		TLM	
14	Kutta-Joukowski Transformation	1	2-02-2024		TLM1	
15	Transformation of Circle to Straight Line, Transformation of Circle to Ellipse	2	3-02-2024 5-02-2024		TLM1	
16	Transformation of Circle to Symmetrical Aerofoil	2	6-02-2024 7-02-2024		TLM1	
17	Transformation of Circle to Cambered Aerofoil	2	9-02-2024 12-02-2024		TLM1	
18	Tutorial	1	13-02-2024		TLM3	
No. of classes required to complete UNIT-II		11		**No. of classes taken:**		

I Mid Examination (26-02-2024 to 02-03-2024)

UNIT-III: THIN AEROFOIL 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
19	Introduction to Aerofoil Theory	1	14-02-2024		TLM1	
20	Airfoil Characteristics	1	16-02-2024		TLM1	
21	Vortex Sheet	1	19-02-2024		TLM1	
22	Kutta Condition, Kelvin's Circulation Theorem, Starting Vortex	2	20-02-2024 21-02-2024		TLM1	
23	**Thin Aerofoil Theory and its applications**	**2**	**23-02-2024 24-02-2024**		**TLM1**	

24.	Application of thin aerofoil theory- Analysis of flow over symmetric airfoil	2	4-03-2024 5-03-2024		TLM1	
25.	Application of thin aerofoil theory- Analysis of flow over cambered airfoil	2	6-03-2024 11-03-2024		TLM1	
26.	Tutorial	1	12-03-2024		TLM3	
No. of classes required to complete UNIT-III		12		**No. of classes taken:**		

UNIT-IV: FINITE WING 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
27.	Finite Wing Theory- Introduction	1	13-3-2024		TLM1	
28.	Down wash and Induced drag, Trailing vortex	1	15-3-2024		TLM1	
29.	Vortex filament	1	16-3-2024		TLM1	
30.	Biot-Savart's law, Infinite and semi-infinite vortex filament	2	18-3-2024 19-3-2024		TLM1	
31.	Helmholtz theorems	1	20-3-2024		TLM1	
32.	Horseshoe Vortex, Prandtl's Classical Lifting Line Theory	2	22-3-2024 23-3-2024		TLM1	
33.	Elliptic Lift Distribution	2	26-3-2024 27-3-2024		TLM1	
34.	General Lift Distribution	1	30-3-2024		TLM1	
35.	Tutorial	1	1-4-2024		TLM3	
No. of classes required to complete UNIT-IV		12		**No. of classes taken:**		

UNIT-V: BOUNDARY LAYER

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Introduction, Boundary Layer Development	1	2-4-2024		TLM1	
37.	Boundary layer Thickness, Boundary layer Displacement Thickness	2	3-4-2024 6-4-2024		TLM1	

38.	Momentum Thickness, Energy Thickness	2	8-4-2024 10-4-2024		TLM1	
39.	Types of Boundary layer, Momentum Integral Estimates	2	12-4-2024 13-4-2024		TLM1	
40.	Karman Analysis of Flat plate	1	15-4-2024		TLM1	
41.	Navier Stokes Equations-Boundary Layer Equations-2D	2	16-4-2024 19-4-2024		TLM1	
42.	Boundary layer growth on a Flat Plate, Blasius Solution	2	20-4-2024 22-4-2024		TLM1	
43.	Boundary Layer with Pressure Gradient	1	23-4-2024		TLM1	
44.	Tutorial	1	24-4-2024		TLM3	
45.	Revision	1	26-4-2024		TLM2	
No. of classes required to complete UNIT-V		**15**		**No. of classes taken:**		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (lab or 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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

PO1: Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: 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.

PO3: 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.

PO4: Conduct Investigation 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.

PO5: Modern Tool Usage: Create, select and apply appropriate techniques, resources, and modern engineering and IT tools including predictions and modeling to complex engineering activities with an understanding of the limitations.

PO6: 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.

PO7: 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.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: 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.

PO11: 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.

PO12: 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.

PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO1: To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design

PSO2: To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Course Instructor	**Module Coordinator**	**HOD**

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF AEROSPACE ENGINERRING

COURSE HANDOUT

PART-A

Name of Course Instructor: Ashutosh Shukla
Course Name & Code **:** Aircraft Structures-I & 20AE07
L-T-P Structure **:2-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech./ IV-Sem **A.Y.:** 2023-24

PREREQUISITE: **Engineering Mechanics**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

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

CO1	Solve problems related to elastic members by applying stress-strain relations
CO2	Analyze the behavior of beams, frames and trusses under various loading conditions (Analyze-L4)
CO3	Analyze the statically indeterminate structures under various loading conditions (Analyze-L4)
CO4	Evaluate the strain energy stored in the structural members (Apply-L3)
CO5	Analyze the buckling of columns and compressive member under various loading conditions (Analyze-L4)

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

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

TEXTBOOKS:

T1 Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Vonostrand Co, 1990.

T2 Bruhn.E.F."Analysis and design of flight vehicle structures" Tri set of offset Company, USA, 1973.

REFERENCE BOOKS:

R1 Donaldson, B.K., "Analysis of Aircraft Structures – An Introduction", McGraw-Hill

R2 B.C.Punmia, "Theory of Structures", Laxmi Publication

R3 S.Ramamrutham, R.Narayanan, "Theory of Structures" – Dhanpat Rai Publishing Co, 2003

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Basic Elasticity

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 Basic Elasticity	1	02-01-2024		TLM1	
2.	Equations of equilibrium	1	03-01-2024		TLM1	
3.	Determination of normal and tangential stresses	1	04-01-2024		TLM1	
4.	Normal and tangential and resultant stresses	1	06-01-2024		TLM1	
5.	Graphical methods to determine stresses	1	09-01-2024		TLM1	
6.	Mohr's circle-uni axial, Bi-axial	1	10-01-2024		TLM1	
7.	Concept of principal planes, stresses and strains	1	11-01-2024		TLM1	
8.	plane stress problems	1	13-01-2024		TLM1	
9.	compatibility equations	1	20-01-2024		TLM3	
10.	stress - strain relations	1	23-01-2024		TLM1	
11.	Two-Dimensional problems-Stress function	1	24-01-2024		TLM1	
12.	Airy's Stress function	1	25-01-2024		TLM1	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Statically Determinate Structures

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.	Introduction to statically determinate structures	1	27-01-2024		TLM1	
14.	Determinacy and Stability	1	30-01-2024		TLM1	
15.	Degree of Redundancy	1	31-01-2024		TLM1	
16.	Principle of Superposition	1	01-02-2024		TLM1	
17.	Reactions of supports of a frame	1	03-02-2024		TLM1	
18.	Analysis of plane truss-types of frame	1	06-02-2024		TLM3	
19.	Method of joints for simple frames	1	07-02-2024		TLM1	
20.	Method of joints for complex frames	1	08-02-2024		TLM1	
21.	Method of sections for simple frames	1	10-02-2024		TLM1	
22.	Method of sections for complex frames	1	13-02-2024		TLM1	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Statically Indeterminate Structures

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Statically Indeterminate structures	1	14-02-2024		TLM1	
24.	Propped cantilever- prop reaction	1	15-02-2024		TLM1	
25.	Propped cantilever with point load and UDL	1	17-02-2024		TLM1	
26.	Fixed beams	1	20-02-2024		TLM1	
27.	Fixed-Fixed beams	1	21-02-2024		TLM3	
28.	SFD BMD of Fixed Beams	1	22-02-2024		TLM1	
29.	Continuous beams	1	24-02-2024		TLM1	
30.	Clapeyron's three moment equation	1	05-03-2024		TLM1	
31.	SFD and BMD of continuous beams	1	06-03-2024		TLM1	
32.	Continuous beam problems	1	07-03-2024		TLM1	
33.	Moment distribution Method	1	09-03-2024		TLM3	
No. of classes required to complete UNIT-III: 11				**No. of classes taken:**		

UNIT-IV: Energy Methods

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.	Introduction to energy methods	1	12-03-2024		TLM1	
35.	Strain Energy due to axial, bending loading	1	13-03-2024		TLM1	
36.	Strain Energy due to Torsion	1	14-03-2024		TLM1	
37.	Deflection of beams using strain energy	1	16-03-2024		TLM1	
38.	Castigliano's first theorem	1	19-03-2024		TLM1	
39.	Deflection of beams using Castigliano's theorem	1	20-03-2024		TLM1	
40.	Castigliano's second theorem	1	21-03-2024		TLM3	
41.	Maxwell's Reciprocal theorem	1	23-03-2024		TLM1	
42.	Unit load method	1	26-03-2024		TLM1	
43.	Deflection of frames by using unit load method	1	27-03-2024		TLM1	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Columns

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
44.	Introduction to columns	1	30-03-2024		TLM1	
45.	Axially loaded compression members	1	02-04-2024		TLM1	
46.	Crushing load- Buckling load	1	03-04-2024		TLM1	
47.	Euler's theory-Effective length	1	04-04-2024		TLM1	
48.	Expressions for buckling load	1	06-04-2024		TLM1	
49.	buckling load with different end conditions	1	08-04-2024		TLM1	
50.	Limitations-Euler's formula	1	10-04-2024		TLM1	
51.	Euler's crushing load	1	12-04-2024		TLM3	
52.	Rankine's formula	1	13-04-2024		TLM1	
53.	Column with initial curvature	1	16-04-2024		TLM1	
54.	Columns subjected to eccentric loading	1	18-04-2024		TLM1	
55.	Euler's method- Rankine's method	1	20-4-2024		TLM1	
No. of classes required to complete UNIT-V: 12				**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.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and 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 knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Course Instructor	Module Coordinator	HOD
(Ashutosh Shukla)	(S.Indrasena Reddy)	(Dr.P.Lovaraju)

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr.K.Venkateswara Reddy
Course Name & Code : Universal Human Values 2: Understanding Harmony (20HS01)
L-T-P Structure : 3-0-0 **Credits** : 3
Program/Sem/Sec : B.Tech IV Semester – ASE **A.Y.** : 2023-24

PREREQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs): To become more aware of themselves and their surroundings (family, society, nature); they would become more responsible in life and in handling problems with sustainable solutions while keeping human relationships and human nature in mind.

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

CO1	Apply the value inputs in life and profession. **(Applying level – L3)**
CO2	Distinguish between values and skills, happiness and accumulation of physical facilities, the self, and the Body. **(Understanding level – L2)**
CO3	Understand the role of a human being in ensuring harmony in society. **(Understanding level – L2)**
CO4	Understand the role of a human being in ensuring harmony in the nature and existence. **(Understanding level – L2)**
CO5	Distinguish between ethical and unethical practices. **(Applying level – 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	3	1	-	-	3	-	-	-
CO2	-	-	-	-	-	1	2	3	3	1	-	2	-	-	-
CO3	-	-	-	-	-	3	2	1	1	1	-	2	-	-	-
CO4	-	-	-	-	-	3	3	2	2	-	-	2	-	-	-
CO5	-	-	-	-	-	2	2	3	1	-	-	3	-	-	-

TEXTBOOKS:

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: Need, Basic Guidelines, content, and Process for 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	02-01-2024		TLM1,2	
2.	'Natural Acceptance' and Experiential Validation	1	05-01-2024		TLM1,2	
3.	Process for self-exploration	1	06-01-2024		TLM1,2	
4.	Continuous Happiness and Prosperity	1	08-01-2024		TLM1,2	
5.	A look at basic human aspirations: Right understanding	1	09-01-2024		TLM1,2	
6.	Active learning activity	1	12-01-2024		TLM6	
7.	Right understanding, Relationship and Physical Facility	1	19-01-2024		TLM1,2	
8.	Understanding Happiness, and Prosperity	1	20-01-2024		TLM1,2	
9.	Formative Assessment	1	22-01-2024		TLM3	
No. of classes required to complete UNIT-I: 9				**No. of classes taken:**		

UNIT-II: Understanding Harmony in the Human Being-Harmony in myself

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Introduction, COs, POs and articulation matrix	1	23-01-2024		TLM1,2	
11.	Understanding Human being as a co-existence of sentient 'I' and the material 'Body'	1	27-01-2024		TLM1,2	
12.	Understanding the needs of self ('I') and 'Body'- Happiness and Physical facility	1	29-01-2024		TLM1,2	
13.	Active learning activity	1	30-01-2024		TLM6	
14.	Understanding the characteristics and activities of 'I' and harmony in 'I'	1	02-02-2024		TLM1,2	
15.	Understanding the harmony of I with the Body: Sanyam and Health	1	03-02-2024		TLM1,2	
16.	Active learning activity	1	05-02-2024		TLM1,2	
17.	Correct appraisal of Physical needs	1	06-02-2024		TLM1,2	
18.	Formative Assessment	1	09-02-2024		TLM3	
No. of classes required to complete UNIT-II: 9				**No. of classes taken:**		

UNIT-III: Understanding Harmony in the Family and society-Harmony in Human- Human Relationship

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
19.	Understanding values in human-human relationship: meaning of justice	1	10-02-2024		TLM1,2	
20.	Program for fulfillment to ensure mutual happiness and Trust	1	12-02-2024		TLM1,2	
21.	Program for fulfillment to ensure mutual happiness and Respect as the foundational values of relationship	1	13-02-2024		TLM1,2	
22.	Understanding Harmony in the society: Resolution	1	16-02-2024		TLM1,2	
23.	Active learning activity	1	17-02-2024		TLM6	
24.	Understanding the harmony in the society: Resolution, Prosperity	1	19-02-2024		TLM1,2	
25.	Understanding the harmony in the society: fearlessness, and co-existence as comprehensive Human Goals	1	20-02-2024		TLM1,2	
26.	Unit end questions format, Question modelling	1	23-02-2024		TLM1	
27.	Multiple choice questions Formative Assessment	1	24-02-2024		TLM1,2	
28.	I-Mid examinations					
29.	Prosperity, fearlessness, and co-existence as comprehensive human goals	2	04-03-2024 05-03-2024		TLM1,2	
30.	Visualizing a universal harmonious order in the society-undivided society	1	09-03-2024		TLM1,2	
31.	Universal order-from family to world family	1	11-03-2024		TLM1,2	
32.	Gratitude as a universal value in relationships	1	12-03-2024		TLM1,2	
No. of classes required to complete UNIT-III: 15				**No. of classes taken:**		

UNIT-IV: Understanding Harmony in the Nature and Existence- Whole existence as Coexistence.

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.	Introduction, COs, POs and articulation matrix	1	15-03-2024		TLM1,2	
34.	Understanding Harmony in the Nature	1	16-03-2024		TLM1,2	
35.	Interconnectedness and mutual fulfillment among four orders of nature	2	18-03-2024 19-03-2024		TLM1,2	
36.	Recyclability and self-regulation in nature	1	22-03-2024		TLM1,2	
37.	Understanding Existence as co-existence of mutually interacting units in all pervasive space	1	23-03-2024		TLM1,2	
38.	Understanding Existence as co-existence of mutually interacting units in all pervasive space	1	26-03-2024		TLM1,2	

39.	Holistic perception of harmony at all levels of existence	1	30-03-2024		TLM1,2	
40.	Active learning activity	1	01-04-2024		TLM6	
41.	Formative Assessment	1	02-04-2024		TLM3	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Implications of the above Holistic understanding of Harmony on professional ethics

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Introduction, COs, POs and articulation matrix	1	06-04-2024		TLM1,2	
43.	Natural acceptance of human values	1	08-04-2024		TLM1,2	
44.	Definitiveness of ethical human conduct	1	12-04-2024		TLM1,2	
45.	Basis for humanistic education	1	13-04-2024		TLM1,2	
46.	Humanistic constitution and humanistic universal order	1	15-04-2024		TLM1,2	
47.	Competence in professional ethics	1	16-04-2024		TLM1,2	
48.	Strategy for transition from the present state to universal human order	1	19-04-2024		TLM1,2	
49.	Active learning activity	1	20-04-2024		TLM6	
50.	Formative Assessment	1	22-04-2024		TLM3	
51.	Revision	3	23-04-2024 26-04-2024 27-04-2024		TLM1,2	
No. of classes required to complete UNIT-V: 14				**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+A	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	**Ethic**s: 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 knowledge of Aerodynamics, Propulsion, Aircraft structures, and Flight Dynamics in Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Mr.K.Venkateswara Reddy**	**Dr.P.Ravindra Kumar**	**Dr. B. SRINIVASA RAO**	**Dr. M.B.S.Sreekara Reddy**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. G V SURYA NARAYANA
Course Name & Code **:** Manufacturing Technology Lab-20AE53 **Regulation**: R20
L-T-P Structure **: 0-0-3** **Credits:** 1.5
Program/Sem/Sec : B.Tech/IV-SEM **A.Y.:** 2023-24

PRE-REQUISITES: Engineering workshop

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of the course are to provide hands-on laboratory experience to acquire basic knowledge in the area of casting, welding and its equipment, lathe machine and special machine operations.

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

CO1	Design and develop a product using casting **(Apply-L3)**
CO2	Fabricate machine components with suitable welding, lathe and other machining operations **(Apply-L3)**
CO3	Manufacture plastic components using various plastic processing techniques **(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
CO1	3	1	1	1	-	-	-	-	-	-	-	1	2	3
CO2	3	1	1	1	-	-	-	-	-	-	-	1	2	3
CO3	3	1	1	1	-	-	-	-	-	-	-	1	2	3
1 - Low						**2** –Medium						**3** - High		

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S. No.	Topics to be covered. (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
			BATCH-I		**BATCH-II**			
1.	Introduction	03	03-01-24		06-01-24		TLM4	
2.	Mould making and Sand Casting	03	10-01-24		20-01-24		TLM4	
3.	Pattern Design and making	03	24-01-24		27-01-24		TLM4	
4.	ARC Welding Butt Joint and Lap joint	03	31-01-24		03-02-24		TLM4	
5.	Spot Welding (chain), Spot Welding (Zigzag)	03	07-02-24		10-02-24		TLM4	
6.	Injection Moulding	03	14-02-24		17-02-24		TLM4	
7.	Repetition	03	21-02-24		24-02-24		TLM4	
8.	Introduction, Lathe Operations: step turning, Tapper turning	03	06-03-24		09-03-24		TLM4	
9.	Lathe Operations: knurling	03	13-03-24		16-03-24		TLM4	
10.	Special Machines: Shaping	03	20-03-24		23-03-24		TLM4	
11.	Special Machines: Milling	03	27-03-24		30-03-24		TLM4	
12.	Special Machines: Drilling, Surface Grinding	03	03-04-24		06-04-24		TLM4	
13.	Repetition	03	10-04-24		20-04-24		TLM4	
14.	Lab internal Exam	03	24-04-27		27-04-23		TLM4	
No. of classes required to complete 14						**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 (R20 Regulation):

Evaluation Task	**Expt. no's**	**Marks**
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A=05
Record = **B**	1,2,3,4,5,6,7,8	B=05
Internal Test = **C**	1,2,3,4,5,6,7,8	C = 05
Cumulative Internal Examination: A + B + C = 15	1,2,3,4,5,6,7,8	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8	**50**

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems.
PEO 2	To train students with good scientific and engineering breadth so as to analyze, design, and create novel products and solutions for the real-life problems
PEO 3	To prepare students to excel in competitive examinations, postgraduate programs, advanced education or to succeed in industry/technical profession
PEO4	To inculcate in students professional and ethical attitude, effective communication skills, teamwork skills, multidisciplinary approach, and an ability to relate engineering issues to broader social context
PEO5	To provide student with an academic environment with awareness of excellence, leadership, and the life-long learning needed for a successful professional career

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures, and Flight Dynamics in Aerospace vehicle design.
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations.

Title	**Course Instructor**	**Module Coordinator**	**Head of the Department**
Signature			
Name of the Faculty	Mr. G V Surya Narayana	Mr. I Dakshina Murthy	Dr. P. Lovaraju

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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DEPARTMENT OF AEROSPACE ENGINEERING

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

Continuous Internal Evaluation (CIE)	*Semester End Examinations (SEE)*
The continuous internal evaluation for laboratory courses (including Computer-aided engineering drawing, computer-aided engineering graphics, Computer aided machine drawing, etc.) is based on the following parameters	The performance of the student in laboratory courses (except design/drawing labs) shall be evaluated jointly by internal and external examiners for 3 hours duration as per the parameters indicated below

Parameter	Marks
Day-to-day work	05
Record	05
Internal test	05
Total	15

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

Rubrics for Evaluation

Day-To-Day Work Evaluation (R20) – 05 Marks

S.No	Criteria	Poor	Average	Good
1	Prerequisites of Experimentation **(2 Marks)**	✓ Doesn't have any idea about the experiment ✓ Failed to have manual/ observation ✓ Could not answer all questions **(0 M)**	✓ Has an idea of the experiment to be conducted. ✓ Present with proper manual/observation ✓ The poor idea of the theoretical background **(1M)**	✓ Met all the prerequisites of the experiment ✓ Sound knowledge of theoretical aspects of the experiment ✓ Proper understanding of experimentation **(2M)**
2	Conduction of Experiment **(2Marks)**	✓ Unable to operate/use the setup ✓ Unable to operate properly **(0M)**	✓ Partial execution of the experimental procedure ✓ Filled to take proper readings **(1M)**	✓ Proper conduction of the experiment ✓ Able to calculate the respective parameters. **(2M)**
3	Results and Inferences **(1 Mark)**		✓ Improper tabulation, missing relevant graphical representations ✓ Partial calculation of results ✓ Failed to interpret the results **(0M)**	✓ Proper tabulations and graphical representations of results ✓ Proper interpretation of results with relevant conclusions **(1M)**

Record Evaluation (R20) – 05 Marks

S.No	Criteria	Poor	Average	Good
1	Diagram and Model Graphs **(2 Marks)**	✓ Diagrams and model graphs are missing **(0M)**	✓ Improper representation of diagrams ✓ Important information is missing in model graphs **(1M)**	✓ Proper representation of diagrams ✓ Important information is provided in model graphs **(2M)**
2	Observations, Calculations, and Results **(2 Marks)**	✓ None of the observations tabulated ✓ Calculations are not shown ✓ Result not written **(0M)**	✓ Improper tabulation of observations/results ✓ Partial calculations are shown. ✓ Wrong interpretation of results **(1M)**	✓ All observations and results are tabulated correctly ✓ Proper calculations are shown and necessary graphs are plotted ✓ Results are interpreted properly **(2M)**
3	Grammar & Neatness **(1 Mark)**		✓ Frequent grammar and/or spelling errors, the writing style is rough and immature **(0M)**	✓ No grammar/spelling corrections are found and well-written **(1M)**

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.I.Dakshina Murthy /Mr.A.Pratyush
Course Name & Code **:** Thermal Engineering Lab-20AE54 **Regulation**: R20
L-T-P Structure **: 0-0-3** **Credits:** 1.5
Program/Sem/Sec : B.Tech/IV-SEM **A.Y.:** 2023-24

PRE-REQUISITES: ICGT & Thermal Engineering

COURSE OBJECTIVE: The objective is to familiarize the principle and its evaluation of various performance parameters of mechanical systems and its impact on global environment.

COURSE OUTCOMES (CO): After completion of course, students will be able to

CO1	Estimate various fuel characteristics through experimental testing(Apply-L3)
CO2	Analyze the performance characteristics of Internal Combustion Engines (Analyze-L4)
CO3	Evaluate the performance parameters of refrigeration and air conditioning systems(Apply-L3)

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	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**
CO2	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**1**
CO3	**3**	**2**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**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

COURSE DELIVERY PLAN (LESSON PLAN):

S. No.	Topics to be covered (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
			BATCH-I		BATCH-II			
1.	Introduction	03	06-01-24		03-01-24		TLM4	
2.	Exp No1.	03	20-01-24		10-01-24		TLM4	
3.	Exp No 2	03	03-02-24		24-01-24		TLM4	
4.	Exp No 3	03	10-02-24		07-02-24		TLM4	
5.	Exp No 4	03	17-02-24		14-02-24		TLM4	
6.	Exp No 5	03	24-02-24		21-02-24		TLM4	
7.	Exp No 6	03	09-03-24		06-03-24		TLM4	
8.	Exp No 7	03	16-03-24		13-03-24		TLM4	
9.	Exp No 8	03	23-03-24		20-03-24		TLM4	
10.	Exp No 9	03	30-03-24		27-03-24		TLM4	
11.	Exp No 10	03	06-04-24		03-04-24		TLM4	
12.	Repetition	03	13-04-24		10-04-24		TLM4	
13.	Lab internal Exam	03	20-04-24		24-04-24		TLM4	
No. of classes required to complete:						**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 (R20 Regulation):

Evaluation Task	**Expt. no's**	**Marks**
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A=05
Record = **B**	1,2,3,4,5,6,7,8	B=05
Internal Test = **C**	1,2,3,4,5,6,7,8	C = 05
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8	**50**

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To provide students with sound mathematical, engineering, and multidisciplinary knowledge to solve Aerospace and Allied Engineering problems
PEO 2	To prepare students to excel in higher education programs and to succeed in industry/academia profession.
PEO 3	To inculcate ethical attitude, leadership qualities, problem solving abilities and life-long learning for a successful professional career

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 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 knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Title	**Course Instructor**	**Module Coordinator**	**Head of the Department**
Signature			
Name of the Faculty	Mr. I Dakshina Murthy	Mr. I Dakshina Murthy	Dr. P. Lovaraju

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
L.B.Reddy Nagar, Mylavaram – 521 230, N.T.R. District, Andhra Pradesh, India
Affiliated to JNTUK, Kakinada & Approved by AICTE New Delhi
Accredited by NAAC with 'A' grade, An ISO 9001:2015 Certified Institution
DEPARTMENT OF AEROSPACE ENGINEERING
Website: https://www.lbrce.ac.in/ase/index.php Email: hodaero@lbrce.ac.in Phone:08659-222933 Ext:624/623

COURSE HANDOUTS

Program	: B. Tech, IV Sem, Aerospace Engineering
Academic year	: 2023-2024
Course name and code	: 20AE55- MATLAB Applications in Engineering Lab
L-T-P structure	: 0-0-3
Course credits	: 1.5
Course instructor	: Dr. Sreenadh Chevula
Course coordinator	: Dr. Sreenadh Chevula

PRE-REQISITE

Course educational objectives : Engineering Mechanics and Numerical methods

COURSE OUTCOMES(CO's) : At the end of the course students are able to

CO1	Apply the basic MATLAB operations in basic engineering problems (Apply-L3)
CO2	Solve the system of linear algebraic equation using matrix operation (Apply-L3)
CO3	Apply the graphical user interface to write the code as more user friendly (Apply-L3)

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

BOS APPROVED TEXTBOOKS

T1 Laboratory Manual & online MATLAB Help portal

COURSE DELIVERY PLAN (LESSON PLAN)

s.No	Experiment name	No of classes required	Tentative date of completion	Actual Date of completion	Teaching Learning method	Learning Outcomes	Textbook Followed	HoD Sign Weekly
	Part I: Introduction to MATLAB							
1	Basic matrix operations	3	02-01-2024	02-01-2024	TLM5 & TLM8	CO1	T1	
2	Solving ordinary differential equations	2	02-Jan-24	02-Jan-24	TLM5 & TLM8	CO1	T1	
3	Solving double integration problems	2	09-Jan-24	09-Jan-24	TLM5 & TLM8	CO1	T1	
4	Plotting of simple 2D and 3D graphs	3	23-Jan-24	23-Jan-24	TLM5 & TLM8	CO1	T1	
5	Introduction to graphical user interface addition and subtraction	6	30-Jan-24	13-Feb-24	TLM5 & TLM8	CO2	T1	
	Part II: Application of MATLAB							
6	Solving of system of linear algebraic equation using matrix	3	20-Feb-24					
	26-02-2024 to 02-03-2024 MID-1 Examination							
7	Solving of ordinary differential equation using Runge-Kutta method a numerical approach	3	12-03-2024		TLM5 & TLM8	CO2	T1	
8	Solving of integration using Simpson s 1/3 rule a numerical approach	6	19-Mar-24		TLM5 & TLM8	CO2	T1	
9	Graphics kinematics of particle position, velocity and acceleration	3	26-Mar-24		TLM5 & TLM8	CO2	T1	
10	Develop the graphical user interface to identify the area moment of inert IA of simple section trapezoidal and triangle	6	02-Apr-24		TLM5 & TLM8	CO2	T1	
11	Develop the graphical user interface to identify the area moment of inert IA of simple section trapezoidal and triangle	6	16-Apr-24		TLM5 & TLM8	CO3	T1	
12	Identification of path line traced by a particle in fluid domain	3	23-Apr-24		TLM5 & TLM8	CO2	T1	
Total No of classes required		46	No of Classes Taken :					

29-04-2024 to 04-05-2024 MID-II Examination

15-04-2024 to 27-04-2024 Semester end examination

Teaching Learning Method

TLM5	Programming
TLM8	Lab Demo

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DEPARTMENT OF INFORMATION TECHNOLOGH

COURSE HANDOUT

PART-A

Name of Course Instructor : CH. POORNA VENKATA SRINIVASA RAO
Course Name & Code : PROBLEM SOLVING USING PYTHON (20ITS1)
L-T-P Structure : 1-0-2 Credits : 2
Program/Sem/Sec : B.Tech., AE., IV-Sem. A.Y : 2023-24
PRE-REQUISITE : C Programming

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The Objective of Python course is to lead the students from the basics of writing and running Python scripts in problem solving and to design and implement the modules and understands the working of classes and objects in python.

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

CO 1	Identify various programming constructs available in Python and apply them in solving computational problems. (Apply - L3)
CO 2	Demonstrate data structures available in Python and apply them in solving computational problem. (Apply - L3).
CO 3	Implement modular programming, string manipulations and Object-oriented programming in python. (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	1	-	-	-	-	-	-	-	3	-	-
CO2	-	3	2	3	2	-	-	-	-	-	-	-	3	-	-
CO3	-	3	2	3	2	-	-	-	-	-	-	-	3	-	-
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-	-

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

1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

PART-B

Introduction: Language basics and example problems (Two weeks)

a) Implement Python Script for checking the given year is leap year or not.
b) Implement Python Script for finding biggest number among 3 numbers.
c) Implement Python Script for displaying reversal of a number.
d) Implement Python Script to check given number is Armstrong or not.
e) Implement Python Script to print sum of N natural numbers.
f) Implement Python Script to check given number is palindrome or not.
g) Implement Python script to print factorial of a number.
h) Implement Python Script to print all prime numbers within the given range.

Module 1: Exercise Programs on Lists.

a) Write a Python script to display elements of list in reverse order.
b) Write a Python script to find the minimum and maximum elements without using built-in operations in the lists.
c) Write a Python script to remove duplicates from a list.
d) Write a Python script to append a list to the second list.
e) Write a Python script to count the number of strings in a list where the string length is 2 or more.

Module 2: Exercise Programs on Tuples.

a) Write a Python script to create a tuple with different data types.
b) Write a Python script to find the repeated items of a tuple.
c) Write a Python script to replace last value of tuples in a list.
   Sample list: [(10, 20, 40), (40, 50, 60), (70, 80, 90)]
   Expected Output: [(10, 20, 100), (40, 50, 100), (70, 80, 100)]
d) Write a Python script to sort a tuple by its float element.
   Sample data: [('item1', '12.20'), ('item2', '15.10'), ('item3', '24.5')]
   Expected Output: [('item3', '24.5'), ('item2', '15.10'), ('item1', '12.20')]

Module 3: Exercise Programs on Sets.

a) Write a Python script to add member(s) in a set.
b) Write a Python script to perform Union, Intersection, difference and symmetric difference of given two sets.
c) Write Python script to test whether every element in S is in T and every element in T is in S.

Module 4: Exercise Programs on Dictionaries

a) Write a Python script to sort (ascending and descending) a dictionary by value.
b) Write a Python script to check whether a given key already exists or not in a dictionary.
c) Write a Python script to concatenate following dictionaries to create a new one.
   Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60}
   Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60}
d) Write a Python script to print a dictionary where the keys are numbers between 1 and 15 (both included) and the values are square of keys.
e) Write a Python program to map two lists into a dictionary.

Module 5: Exercise Programs on functions and recursion.

a) Define a function max_of_three() that takes three numbers as arguments and returns the largest of them.
b) Write a program which makes use of function to display all such numbers which are divisible by 7 but are not a multiple of 5, between given range X and Y.
c) Define functions to find mean, median, mode for the given numbers in a list.
d) Define a function which generates Fibonacci series up to n numbers.
e) Implement a python script for factorial of number by using recursion.
f) Implement a python script to find GCD of given two numbers using recursion.

Module 6: Exercise programs on Strings

a) Implement Python Script to perform various operations on string using string libraries.
b) Implement Python Script to check given string is palindrome or not.
c) Implement python script to accept line of text and find the number of characters, number of vowels and number of blank spaces in it.
d) Implement python script that takes a list of words and returns the length of the longest one.

Module 7: Exercise programs on Regular Expressions

a) Write a Python script to check that a string contains only a certain set of characters (in this case a-z, A-Z and 0-9).
b) Write a Python script to check whether password is valid or not.

   Conditions for a valid password are:
   Should have at least one number.
   Should have at least one uppercase and one lowercase character.
   Should have at least one special symbol.
   Should be between 6 to 20 characters long.

Module 8: Exercise programs on Matplotlib Library.

a) Write a Python program to draw a line with suitable label in the X axis, Y axis and a title.

b) Write a Python program to plot two or more lines with legends, different widths and colors.
c) Write a Python program to create multiple plots.
d) Write a Python programming to display a bar chart using different color for each bar.
e) Write a Python programming to create pie chart with a title.
f) Write a Python programming to draw a scatter plot with empty circles taking a random distribution in X and Y and plotted against each other

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

S.No.	Programs to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1.	Installation and Working on Interpreter Language Basics and Example Programs	3	04.01.2024		TLM4	CO1,CO4	
2.	Module 0 program basic programs	3	11.01.2024		TLM4	CO1,CO4	
3.	Module-1 Programs on Lists	3	18.01.2024		TLM4	CO1,CO4	
4.	Module-2 Programs on Tuples	3	25.01.2024		TLM4	CO2,CO4	
5.	Module-3 Programs on Sets	3	01.02.2024		TLM4	CO2,CO4	
6.	Module- 4 Programs on Dictionaries	3	08.02.2024		TLM4	CO2,CO4	
7.	Module-5 Programs on Functions & Recursions	3	15.02.2024		TLM4	CO3,CO4	
	1st MID Examinations						
8.	Module-6 Exercise programs on Strings	3	22.02.2024		TLM4	CO3,CO4	
9.	Module-7 Exercise programs on Regular Expressions	3	07.03.2024		TLM4	CO3,CO4	
10.	Module-7 Exercise programs on Regular Expressions	3	14.03.2024		TLM4	CO3,CO4	
11.	Module-8 Exercise programs on Matplotlib Library	3	21.03.2024		TLM4	CO3,CO4	
12.	Module-8 Exercise programs on Matplotlib Library	3	28.03.2024		TLM4	CO3,CO4	
13.	Module-8 Exercise programs on Matplotlib Library	3	04.04.2024		TLM4	CO3,CO4	
14.	Internal Lab Exam	3	18.04.2024				

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): for LABORATORY COURSES

(a) Continuous Internal Evaluation(CIE)

Parameter	Marks
Day-to-day work	05
Record	05
Internal test	05
Total	**15**

(a) Semester End Examination (SEE)

Parameter	Marks
Procedure / Algorithm	05
Experimentation/Program execution	10
Internal test	10
Observations/Calculations/Validation	05
Result/Inference	05
Viva voce	05
Total	**35**

PART-D

PROGRAMME OUTCOMES (POs):

PO1	**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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PO3	**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.
PO4	**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.
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PO11	**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.
PO12	**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):

PSO1	Organize, Analyze and interpret the data to extract meaningful conclusions.
PSO2	Design, Implement and Evaluate a computer-based system to meet desired needs
PSO3	Develop IT application services with the help of different current engineering tools.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Mr. Ch. Poorna Venkata Srinivasa Rao**	**Mr. Ch. Poorna Venkata Srinivasa Rao**	**Dr. K. Phaneendra**	**Dr. B. Srinivasa Rao**
Signature				