

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 NBA under Tier – I, Accredited by NAAC with 'A' grade,
 An ISO 21001:2018, 500001:2018, 14001:2015 Certified Institution

DEPARTMENT OF AEROSPACE ENGINEERING

Estd.: 1998

Website: <http://www.lbrce.ac.in/ase/index.php> Email: hodaero@lbrce.ac.in Phone: 08659-222933 Ext: 624/623

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. Nazumuddin Shaik

Course Name & Code : Aerospace Vehicle Structures-23AE07

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

Credits: 3

Program/Sem/Sec : B. Tech, V-Sem

A.Y.: 2026-27

PREREQUISITE: Engineering Mechanics and Strength of Materials

COURSE EDUCATIONAL OBJECTIVE (CEO): To comprehend fundamentals of elasticity and failure theories, analysis of various Aerospace structural components under various loading conditions and application of energy methods to structural components.

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

COs	Statements	Blooms Level
CO1	Apply the stress and strain relations in elastic members and relevant failure theories to aerospace components.	Apply
CO2	Evaluate statically indeterminate beam structures subjected to various loading conditions.	Apply
CO3	Apply strain energy methods and theorems to beams and trusses under different loading conditions	Apply
CO4	Analyze the stability and critical buckling loads of columns under axial and eccentric loadings	Analyze
CO5	Estimate bending stresses in beams subjected to unsymmetrical bending	Apply

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	2	-	-	-	-	-	-	-	2	2	3
CO2	3	3	2	2	-	-	-	-	-	-	-	2	2	3
CO3	3	3	2	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3
			1 - Low			2 -Medium			3 - High					

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

TEXTBOOKS:

T1	T.H.G. Megson – Aircraft Structures for Engineering Students, 6th Edition, Butterworth Heinemann, 2016.
T2	Ramamrutham, S., and Narayanan, R. (2022). Theory of Structures, 11th Edition, Dhanpat Rai Publishing Company.

REFERENCE BOOKS:

R1	Bruce K. Donaldson – Analysis of Aircraft Structures: An Introduction, 2 nd Edition, Cambridge University Press, 2008.
R2	R.C. Hibbeler – Mechanics of Materials, 10th Edition, Pearson Education, 2016.
R3	S. Timoshenko and D.H. Young – Elements of Strength of Materials, 5th Edition, CBS Publishers, 2017.

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 Course and COs	1	29-06-2026		TLM1&2	
2.	Introduction to Unit-I Basic Elasticity	1	02-07-2026		TLM1&2	
3.	Stresses and Strains	1	04-07-2026		TLM1&2	
4.	Equations of Equilibrium	1	06-07-2026		TLM1	
5.	Plane Stress and Plane Strain Problems	1	09-07-2026		TLM1	
6.	Compatibility Equations	1	13-07-2026		TLM1	
7.	Stress - Strain Relations & Airy's Stress Function	1	16-07-2026		TLM1	
8.	Failure Theories: Maximum Stress Theory & Maximum Strain Theory	1	18-07-2026		TLM1	
9.	Maximum Shear Stress Theory & Maximum Strain Energy Theory	1	20-07-2026		TLM1	
10.	Distortion Energy Theory	1	23-07-2026		TLM1	
11.	Tutorial-I	1	25-07-2026		TLM3	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: 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
12	Introduction to Unit-II Statically indeterminate structures	1	27-07-2026		TLM1&2	
13	Methods for Indeterminate Beams	1	30-07-2026		TLM1&2	
14	Indeterminate structure, order of redundancy	1	01-08-2026		TLM1&2	
15	Propped Cantilever	1	03-08-2026		TLM1	
16	Fixed-Fixed Beams	1	06-08-2026		TLM1	
17	Continuous Beams Carrying Point Load	1	10-08-2026		TLM1	
18	Continuous Beams Carrying Uniformly Distributed Load	1	13-08-2026		TLM1	
19	Shear Force and Bending Moment Diagrams	1	17-08-2026		TLM1	
20	Clapeyron's Three Moment Equation.	1	20-08-2026		TLM1	
21	Tutorial-II	1	22-08-2026		TLM3	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: AIRCRAFT STRUCTURAL COMPONENTS AND 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
22	Introduction to Unit-III Functions of structural components	1	31-08-2026		TLM1	
23	Airframe loads, Types of structural joints, Type of loads on structural joints	1	03-09-2026		TLM1&2	
24	Strain Energy: Strain Energy Stored in a Beam due to Axial Load	1	05-09-2026		TLM1	
25	Strain Energy due to Bending Moment	1	07-09-2026		TLM1	
26	Castigliano's First and Second Theorems	1	10-09-2026		TLM1	
27	Tutorial-III	1	12-09-2026		TLM3	

28	Maxwell's Reciprocal Theorem	1	14-09-2026		TLM1&2
29	Unit Load Method - Application to Beams and Trusses	1	17-09-2026		TLM1&2
No. of classes required to complete UNIT-III: 08				No. of classes taken:	

UNIT-IV: 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
30	Introduction- Axially Loaded Compression Members	1	19-09-2026		TLM1	
31	Crushing Load-Buckling Load	1	21-09-2026		TLM1&2	
32	Euler's Theory- Effective Length of Column	1	24-09-2026		TLM3	
33	Expressions for Buckling Load With Different Column End Conditions	1	26-09-2026		TLM1&2	
34	Expressions for Buckling Load With Different Column End Conditions	1	28-09-2026		TLM1	
35	Limitations-Euler's Formula Rankine's Formula, Columns Subjected to Eccentric Loading	1	01-10-2026		TLM1&2	
36	Tutorial-IV	1	03-10-2026		TLM3	
No. of classes required to complete UNIT-IV: 07				No. of classes taken:		

UNIT-V: UNSYMMETRICAL BENDING

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	Introduction to Unit V Principal Axis Method	1	05-10-2026		TLM1	
38	Neutral Axis Method	1	08-10-2026		TLM1	
39	Bending Stresses	1	12-10-2026		TLM1	
40	Beams of Symmetric	1	15-10-2026		TLM1&2	

	Sections with Symmetric Loads				
41	Beams of Symmetric Sections with Skew Loads	1	17-10-2026		TLM1&2
42	Beams of Unsymmetrical Sections with Symmetric Loads	1	26-10-2026		TLM1
43	Beams of Unsymmetrical Sections with Skew Loads.	1	29-10-2026		TLM1&2
44	Tutorial-V	1	31-10-2026		TLM3
No. of classes required to complete UNIT-V: 08				No. of classes taken:	

Advanced Topics/ beyond Syllabus in AVS

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.	Shear Flow		10-10-2026		TLM1	
2.	Shear Centre		10-10-2026		TLM1	

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

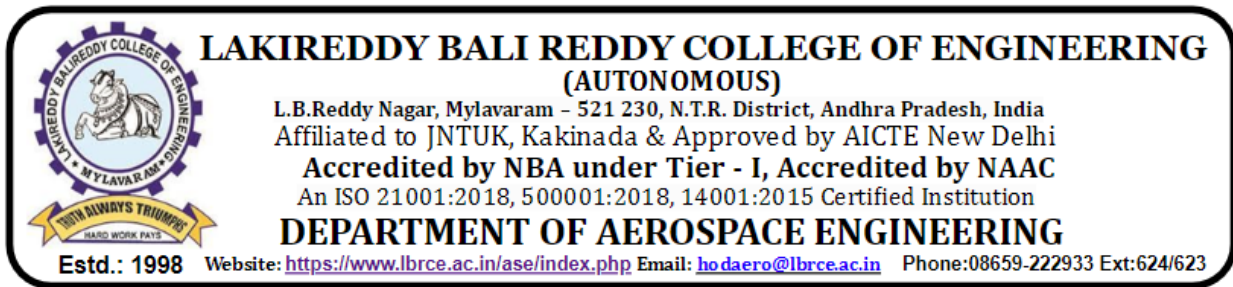
Engineering Graduates will be able to:

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 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.
PO 5	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.
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, Flight Dynamics and Aircraft structures in the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations.

Signature			
Name of the Faculty	Mr. Nazumuddin Shaik	Mr. Nazumuddin Shaik	Dr. P. Lovaraju
Title	Course Instructor	Module Coordinator	Head of the Department



COURSE HANDOUT

PART-A

Name of Course Instructor : **Dr. P. Lovaraju**
 Course Name & Code : Gas Dynamics and 23AE08
 L-T-P Structure : 3-0-0 Credits : 3
 Program/Sem/Sec : B.Tech., V-Sem. A.Y : 2026-2027

Pre-requisites: Engineering Fluid Mechanics, Engineering Thermodynamics, Aerodynamics

Course Educational Objectives: To learn the basic concepts of compressible fluid flows, properties of steady one-dimensional flow and supersonic flows, compressible flow with friction and heat transfer and compressible flow over wings

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

COs	Statements	Blooms Level
CO1	Apply the of compressible fluid flow equations to solve flow problems	Apply
CO2	Apply steady one-dimensional flow principles in designing nozzles and diffusers	Apply
CO3	Analyze the supersonic flow behavior over objects	Analyze
CO4	Analyze fluid flow through ducts by considering friction and heat transfer affects	Analyze
CO5	Apply compressible flow theory to analyze flow over wings	Apply

CourseCode	COs	Program Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
20AE09	CO1	3	3	2	2	-	-	-	-	-	-	-	3	3	3
	CO2	3	2	2	2	-	-	-	-	-	-	-	3	3	3
	CO3	3	3	2	3	-	-	-	-	-	-	-	3	3	3
	CO4	3	2	2	3	-	-	-	-	-	-	-	3	3	3
	CO5	3	2	2	3	-	-	-	-	-	-	-	3	3	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).

TEXT BOOK

- Rathakrishnan. E, Gas Dynamics, 7th Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2021
- John D Anderson, Jr. Fundamentals of Aerodynamics, 7th Edition, McGraw-Hill, 2024

REFERENCES

- Ascher H. Shapiro, The dynamics and thermodynamics of compressible fluid flow Vol 1, The Ronald press Co. New York
- Lipmann. H. W, Roshko. A, Elements of Gas Dynamics, Dover Special Priced Titles, 2007

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: BASICS OF COMPRESSIBLE 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, Course outcome, Introduction	1	30-06-2026		TLM1	
2.	Revision of Thermodynamics related to this course	1	1-07-2026		TLM2	
3.	Compressibility and its limiting conditions	1	3-07-2026		TLM1	
4.	Speed of Sound and its thermodynamics formulation	1	7-07-2026		TLM1	
5.	Isentropic relations suitable for Compressible flows (in terms of Mach number),	2	8-07-2026 10-07-2026		TLM2	
6.	Stagnation Properties	1	14-07-2026		TLM1	
7.	Mach Angle, Mach cone, Mach wave, Shock Wave, Wave propagation	1	15-07-2026		TLM2	
8.	Tutorial-I	1	17-07-2026		TLM3	
9.	Assignment/Quiz 1					
No. of classes required to complete UNIT-I: 9				No. of classes taken:		

UNIT-II: STEADY ONE-DIMENSIONAL 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
10.	Introduction, Fundamental Equations	1	21-07-2026		TLM1	
11.	Discharge from a reservoir formulation	2	22-07-2026 24-07-2026		TLM1	
12.	Mass flow per Unit Area, Critical Values	1	28-07-2026		TLM1	
13.	Stream tube Area velocity relation	1	29-07-2026		TLM1	
14.	Nozzle and its types, Applications of Nozzle, De Laval Nozzle	1	31-07-2026		TLM1	
15.	Area Mach number relation	1	4-08-2026		TLM1 & TLM2	
16.	Isentropic flow through nozzle, Nozzle flow physics	1	5-08-2026		TLM1	
17.	Diffusers, Compressibility correction to dynamic pressure	1	7-08-2026		TLM1	
18.	Tutorial-II	1	11-08-2026		TLM3	
19.	Assignment/Quiz 2					
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

I MID EXAMINATION

24-08-2026 to 29-08-2026

UNIT-III: SHOCK AND EXPANSION WAVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20.	Introduction and Types of Waves	1	12-08-2026		TLM2	
21.	Normal Shock-Equations of Motion, Normal Shock relation for perfect gas	2	14-08-2026 18-08-2026		TLM1	
22.	Hugoniot Equation	1	19-08-2026		TLM1	
23.	Oblique Shock introduction, Oblique Shock relations	2	21-08-2026 1-09-2026		TLM1	
24.	Relation Between β - θ -M	1	2-09-2026		TLM1	
25.	Shock polar, Detached shocks, Expansion waves, Prandtl Meyer Flow	1	8-09-2026		TLM1 & TLM2	
26.	Flow with shocks and expansion waves at the exit of a convergent- divergent nozzle, simple and non-simple regions	1	9-09-2026		TLM 1	
27.	Tutorial-III	1	11-09-2026		TLM 3	
28.	Assignment/Quiz 3					
No. of classes required to complete UNIT-III: 10				No. of classes taken:		

UNIT-IV: FLOW WITH FRICTION AND HEAT TRANSFER

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29.	Introduction, Flow in constant Area Duct with friction	1	15-09-2026		TLM1	
30.	Adiabatic Constant area flow of a perfect gas (basic Formulation)	1	16-09-2026		TLM1	
31.	Definition of Friction Coefficient, Effect of Wall Friction on Fluid Properties	1	18-09-2026		TLM1	
32.	Working Relations, Fanno line flow	1	22-09-2026		TLM1	
33.	Flow with heating and cooling in ducts, Rayleigh line relation	1	23-09-2026		TLM1	
34.	Basic Formulation	1	25-09-2026		TLM1	
35.	Working Relations	1	29-9-2026		TLM1	
36.	Tutorial - 4	1	30-9-2026		TLM3	
37.	Assignment/Quiz 4					
No. of classes required to complete UNIT-IV: 08				No. of classes taken:		

UNIT-V: COMPRESSIBLE FLOW OVER WINGS

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, Potential Equation for Compressible flow	2	6-10-2026 7-10-2026		TLM1&2	
2.	Linearization of Potential Equation	1	9-10-2026		TLM1 & 2	
3.	Prandtl-Glauert Rule	1	13-10-2026		TLM1&2	
4.	Critical Mach Number	1	14-10-2026		TLM1	
5.	Drag-Divergence Mach Number	1	16-10-2026		TLM1&2	
6.	Area-Rule, Supercritical Aerofoil, Forward Swept and Swept Back Wings, Delta Wings	1	27-10-2026		TLM1&2	
7.	Tutorial -5	1	28-10-2026		TLM3	
8.	Assignment/Quiz 5					
No. of classes required to complete UNIT-V:8				No. of classes taken:		

Revision/Advanced Topics/Content Covered beyond Syllabus:

S.No.	Topics to be covered	Dates	TLM
1.	Revision	30-10-2026	TLM2
2.	Hypersonic Flows Introduction & Basic Aspects, Applications		TLM2

Mid-2	2-11-2026 to 7-11-2026
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Teaching Learning Methods			
TLM1	Chalk and Talk	TLM4	Demonstration (Lab/Field Visit)
TLM2	PPT	TLM5	ICT (NPTEL/Swayam Prabha/MOOCs)
TLM3	Tutorial	TLM6	Group Discussion/Project

PART-C**EVALUATION PROCESS (R20 Regulations):**

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 modeling to complex engineering activities with an understanding of the limitations
PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the 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`
Dr. P. Lovaraju

Module Coordinator
Dr. P. Lovaraju

HOD
Dr. P. Lovaraju



COURSE HANDOUT

PART-A

Name of Course Instructor:	Mr. G V SURYA NARAYANA	Regulation:	R23
Course Name & Code:	23AE09-Aircraft Systems and Instruments	Credits:	3
L-T-P Structure:	3-0-0	A.Y.:	2026-27
Program/Sem/Sec:	B.Tech-V SEM		

PREREQUISITE: Elements of Aerospace Engineering

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the conventional and modern control systems and working principles of different types of hydraulic and pneumatic systems, engine systems, auxiliary systems, and flight and navigation instruments used in an aircraft.

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

COs	Statements	Blooms Level
CO1	Identify the various types of controls in the airplane design	Understand-L2
CO2	Understand the performance of hydraulic and pneumatic systems in the aircraft operations	Understand-L2
CO3	Understand the working of various engine systems of an aircraft	Understand-L2
CO4	Understand the functioning of auxiliary systems in the operation of an aircraft	Understand-L2
CO5	Understand the working of various instruments necessary for the aircraft operation	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	1	1	1	-	-	-	-	-	-	-	3	2	3
CO2	3	1	1	1	-	-	-	-	-	-	-	3	2	3
CO3	3	1	1	1	-	-	-	-	-	-	-	3	2	3
CO4	3	1	1	1	-	-	-	-	-	-	-	3	2	3
CO5	3	1	1	1	-	-	-	-	-	-	-	3	2	3
	1 - Low				2 -Medium				3 - High					

TEXTBOOKS:

- T1** McKinley. J. L, Bent. R.D, Aircraft Maintenance and Repair, McGraw-Hill, 1993.
- T2** General Handbooks of Airframe and Power Plant Mechanics, U.S. Dept. Of Transportation, Federal Aviation Administration, The English Book Store, New Delhi1995.

REFERENCE BOOKS:

- R1** Mekinley. J. L, Bent. R. D, Aircraft Power Plants, McGraw-Hill, 1993.
- R2** Pallet. E. H. J, Aircraft Instruments & Principles, Pitman & Co, 1993.
- R3** Treager. S, Gas Turbine Engine Technology, Third Edition, McGraw-Hill Education.

PART-B**COURSE DELIVERY PLAN (LESSON PLAN):****UNIT-I: AIRPLANE CONTROL SYSTEMS:**

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 Aircraft Systems and Instruments	01	29-06-2026		TLM1, TLM2	
2.	Introduction to Airplane Control Systems	01	01-07-2026		TLM1, TLM2	
3.	Conventional Control Surfaces	01	03-07-2026		TLM1, TLM2	
4.	Power Assisted Flight Controls	01	06-07-2026		TLM1, TLM2	
5.	Fully Powered Flight Controls, Power Actuated Systems	01	08-07-2026		TLM1, TLM2	
6.	Engine Control Systems (FADEC)	01	10-07-2026		TLM1, TLM2	
7.	Push Pull Rod System, Operating Principles, Modern Control Systems	01	13-07-2026		TLM1, TLM2	
8.	Digital Fly by Wire Systems, Auto Pilot System, Active Control Technology	01	15-07-2026		TLM1, TLM2	
9.	Basic Aircraft Wiring Practices, Aircraft Systems Assignment-I	01	20-07-2026		TLM1, TLM2	
No. of classes required to complete UNIT-I: 09				No. of classes taken:		

UNIT-II: AIRCRAFT SYSTEMS:

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 to Aircraft Systems	01	22-07-2026		TLM1, TLM2	
11.	Hydraulic and Pneumatic Systems	01	24-07-2026		TLM1	
12.	Study of a Typical Workable System, Components and Advantages	01	27-07-2026		TLM1	
13.	Working Principles, Typical Air Pressure System	01	29-07-2026		TLM1, TLM2	
14.	Cabin pressurization	01	31-07-2026		TLM1	
15.	heating systems, cooling systems,	01	03-08-2026		TLM1	
16.	Brake System, Typical Pneumatic Power System	01	05-08-2026		TLM1	

17.	Components, Landing Gear Systems	01	07-08-2026		TLM1, TLM2
18.	Classifications of air Oleo Assignment-I	01	10-08-2026		TLM1
No. of classes required to complete UNIT-II: 09				No. of classes taken:	

Examination	Starting Date	Ending Date
I Mid Examination	24-08-2026	29-08-2026

UNIT-III: ENGINE SYSTEMS:

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.	Fuel Systems for Piston and Jet Engines	01	12-08-2026		TLM1	
20.	Fuel Systems for Jet Engines	01	14-08-2026		TLM1, TLM2	
21.	Components of multi-engines	01	17-08-2026		TLM1	
22.	Modern Fuel System Components	01	19-08-2026		TLM1, TLM2	
23.	Boost pumps, selector valves, ejector pumps	01	21-08-2026		TLM1, TLM2	
24.	Lubricating Systems for Piston	01	22-08-2026		TLM1	
25.	Lubricating Systems for Jet Engines	01	31-08-2026		TLM1, TLM2	
26.	Electrical Starting and Ignition Systems	01	02-09-2026		TLM1, TLM2	
27.	Ignition Systems Assignment-II	01	07-09-2026		TLM1, TLM2	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

UNIT-IV: AUXILIARY SYSTEM:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Introduction to Auxiliary System, Auxiliary power unit (APU)	01	09-09-2026		TLM1, TLM2	
29.	Basic Air Cycle Systems,	01	11-09-2026		TLM1	
30.	Vapour Cycle Systems	01	16-09-2026		TLM1	

31.	Boot-Strap Air Cycle System,	01	18-09-2026		TLM1	
32.	Evaporative Vapour Cycle Systems	01	21-09-2026		TLM1, TLM2	
33.	Evaporation of Air Cycle Systems, Oxygen Systems	01	23-09-2026		TLM1	
34.	Ice and Rain Protection Systems, De-icing and Anti-Icing System	01	25-09-2026		TLM1, TLM2	
35.	Fire Protection Systems, Aircraft Warning System	01	28-09-2026		TLM1, TLM2	
36.	Caution, Advisory, and Fault Alerts. Assignment-II	01	30-09-2026		TLM1, TLM2	
No. of classes required to complete UNIT-IV: 09				No. of classes taken:		

UNIT-V: AIRCRAFT INSTRUMENTS:

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.	Flight and Navigation Instruments	01	05-10-2026		TLM1	
38.	Principles and Operation of Accelerometers, Air Speed Indicators	01	07-10-2026		TLM1, TLM2	
39.	Mach Meters, Altimeters	01	09-10-2026		TLM1, TLM2	
40.	Gyroscopic Instruments	01	12-10-2026		TLM1	
41.	VOR, DME,	01	14-10-2026		TLM1, TLM2	
42.	GPS, INS	01	16-10-2026		TLM1, TLM2	
43.	Study of Various Types of Engine Instruments Operation and Principles – Tachometers	01	26-10-2026		TLM1, TLM2	
44.	Temperature Gauges, Pressure Gauges. Assignment-II	01	28-10-2026		TLM1	
No. of classes required to complete UNIT-V: 08				No. of classes taken:		

Advanced Topics:

S. No.	Advance Topic	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
45.	Advance controls and Systems	01	30-10-2026		TLM1, TLM5	
46.	Advanced Engine control parameters	01	30-10-2026		TLM1, TLM5	

47.	Advance Instruments	01	30-10-2026		TLM1, TLM5	
No. of Advance classes required to complete: 03				No. of classes taken:		

Examination	Starting Date	Ending Date
II Mid Examination	02-11-2026	07-11-2026

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

Description	From	To	Weeks
Commencement of Class Work	29-06-2026		
I Phase of Instructions	29-06-2026	22-08-2026	8 W
I MID Examinations	24-08-2026	29-08-2026	1 W
II Phase of Instructions	31-08-2026	17-10-2026	7 W
Dussehra Holidays	19-10-2026	24-10-2026	1 W
II Phase of Instructions (Continued)	26-10-2026	31-10-2026	1 W
II MID Examinations	02-11-2026	07-11-2026	1 W
Preparation and Practicals	09-11-2026	14-11-2026	1 W
Semester End Examinations	16-11-2026	28-11-2026	2 W

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

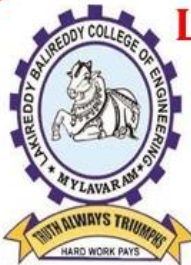
PROGRAMME OUTCOMES (POs):

PO1	Engineering knowledge: To 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 modelling, 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 teamwork: 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures, and Flight Dynamics in Aerospace vehicle design.
PSO2	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. G V SURYA NARAYANA	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 NBA (Tier - I) and NAAC with 'A' grade, An ISO 9001:2015 Certified

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 HANDOUT

PART-A

Name of Course Instructor: B. Udaya Lakshmi

Course Name & Code : FEA & 23AE11

L-T-P Structure :3-1-0

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

Credits: 3

A.Y.: 2026-27

PREREQUISITE: Engineering Mechanics

COURSE EDUCATIONAL OBJECTIVES (CEOs):

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

COs	Statements	Blooms Level
CO1	Apply mathematical model for solution of common engineering problems	Apply
CO2	Solve 2-Dimensional Structural Problems using CST Element	Apply
CO3	Apply Axi-symmetric modelling concepts to solids of revolution for stress approximation	Apply
CO4	Analyze the structural behavior of Trusses and Beams Elements	Analyze
CO5	Estimate the natural frequencies and mode shapes of the bar elements	Apply

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	2	1	-	-	-	-	-	-	-	2	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO4	3	3	2	3	-	-	-	-	-	-	-	3	3	3
CO5	3	3	3	2	-	-	-	-	-	-	-	3	3	3
	1 - Low			2 -Medium			3 - High							

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

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

REFERENCES

1. Chandraputla, Ashok, Belegundu., Introduction to Finite Elements in Engineering, 4th edition, Pearson Education India, 2015
2. Rao. S. S, The Finite Element Methods in Engineering, 4th edition, 6th reprint, B.H. Pergamon, 2010.
3. Reddy. J. N, An introduction to Finite Element Method, 3rd edition, 13th reprint, McGraw, Hill, 2011.
4. Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith, Ted G. Byrom., The Finite Element Method for Engineers, 4th edition, John Wiley & Sons (ASIA) Pvt Ltd, 2001.
5. David Hutton., Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005
6. George R Buchanan, R. Rudra Moorthy., Finite Element Analysis, Tata McGraw Hill, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION TO FEM & 1-D PROBLEMS

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 FEM	1	30-6-2026		TLM1	
2.	Equilibrium equations	1	3-7-2026		TLM1	
3.	Stresses and equilibrium	1	4-7-2026		TLM1	
4.	Strain displacement relations	1	7-7-2026		TLM1	
5.	Stress strain relations	1	10-7-2026		TLM1	
6.	Plane stress and plane strain problems	1	11-7-2026		TLM1	
7.	Problems on stress strain relations	1	14-7-2026		TLM1	
8.	Potential energy and equilibrium method	1	17-7-2026		TLM1	
9.	FE Formulation from governing diff. equations	1	18-7-2026		TLM1	
10.	Weighted residual methods	1	21-7-2026		TLM1	
11.	FE Modeling, 1-D bar problems	1	24-7-2026		TLM1	
12.	coordinates of shape functions	1	25-7-2026		TLM1	
13.	Assembly of GSM & Load vector	1	28-7-2026		TLM3	
14.	Finite element equations	1	31-7-2026		TLM1	
15.	FE-treatment of boundary conditions	1	1-08-2026		TLM1	
16.	Numerical	1	4-8-2026		TLM1	
17.	Numerical	1	7-8-2026		TLM1	
18.	Assignment, Quiz-I		7-8-2026			
No. of classes required to complete UNIT-I: 17				No. of classes taken:		

UNIT-II: TWO DIMENSIONAL PROBLEMS

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.	Finite element modeling CST	1	8-8-2026		TLM1	
20.	Isoparametric Representation-Shape functions	1	11-8-2026		TLM1	
21.	Derivation of stiffness matrix	1	14-8-2026		TLM1	
22.	Strain Displacement matrix	1	18-8-2026		TLM1	
23.	CST-force terms	1	21-8-2026		TLM1	
24.	Stress Calculations	1	22-8-2026		TLM1	
25.	Numericals	1	25-8-2026		TLM1	
26.	Numericals	1	28-8-2026		TLM3	
27.	Assignment, Quiz-II	1	29-8-2026			
No. of classes required to complete UNIT-II: 09				No. of classes taken:		

I MID EXAMINATION

24-08-2026 to 29-08-2026

UNIT-III: FINITE ELEMENT MODELING OF AXISYMMETRIC SOLIDS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28.	Axisymmetric solids	1	1-9-2026		TLM1	
29.	Finite element modeling-Jacobian Matrix	1	4-9-2026		TLM1	
30.	Element Stiffness matrix	1	5-9-2026		TLM1	
31.	Axisymmetric loading with triangular elements	1	8-9-2026		TLM1	
32.	Axisymmetric Problems	1	11-9-2026		TLM1	
33.	Problems on Axisymmetric Loading	1	12-9-2026		TLM1	

34.	Four noded isoparametric elements	1	15-9-2026		TLM3	
35.	Jacobian, shape functions	1	15-9-2026		TLM1	
36.	4- node quadrilateral element	1	18-9-2026		TLM1	
37.	Numerical integration	1	19-9-2026		TLM1	
38.	Gauss Quadrature	1	22-9-2026		TLM1	
39.	Assignment,Quiz-III	1				
No. of classes required to complete UNIT-III: 12			No. of classes taken:			

UNIT-IV: ANALYSIS OF TRUSSES AND BEAMS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Introduction- Plane Trusses	1	25-9-2026		TLM1	
41.	Local and Global Coordinate system- Transformation matrix	1	26-9-2026		TLM1	
42.	Element Stiffness Matrix, stress Calculations	1	29-9-2026		TLM1	
43.	Numericals on trusses	1	3-10-2026		TLM1	
44.	Introduction- Beams, Hermite shape functions	1	6-10-2026		TLM3	
45.	Element stiffness matrix	1	9-10-2026		TLM1	
46.	Load vector, Boundary conditions	1	10-10-2026		TLM1	
47.	Numericals on beams	1	13-10-2026		TLM1	
48.	Assignment, Quiz-IV	1	13-10-2026			
No. of classes required to complete UNIT-IV: 11			No. of classes taken:			

UNIT-V: DYNAMIC 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
49.	Dynamic Analysis formulation	1	16-10-2026		TLM1	
50.	Lumped mass matrices, Consistent mass matrices	1	16-10-2026		TLM1	
51.	Evaluation of Eigen values, Eigen vectors	1	17-10-2026		TLM1	
52.	Characterstics	1	27-10-2026		TLM1	
53.	Stepped bars Problems- Eigen values	1	30-10-2026		TLM1	
54.	Problems	1	30-10-2026		TLM1	
55.	Assignment, Quiz-V	1	31-10-2026		TLM3	
No. of classes required to complete UNIT-V: 12			No. of classes taken:			

II MID EXAMINATION

2-11-2026 to 7-11-2026

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

PART-C

EVALUATION PROCESS (R17 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO 3	Design/Development of Solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct 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.
PO 5	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.
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 the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Course Instructor	Module Coordinator	HOD
B. Udaya Lakshmi	S. Indrasena Reddy	Dr. P. Lovaraju



COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.V.V.Rama Krishna
 Course Name & Code : Fundamentals of Satellite Communications-23EC85
 L-T-P Structure : 3-0-0 Credits : 3
 Program/Sem/Sec : B.Tech, ASE, V-Sem A.Y : 2026-27
PRE-REQUISITE : Dynamics, Kinematics, Thermo dynamics.

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the knowledge on laws associated with the motion of a satellite, launching a satellite into orbit with launch vehicles, subsystems, structures, spacecraft control and applications.

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

CO 1	Describe the operational frequency bands, Space craft control mechanisms, sensors and navigational aids used in satellite systems Understand-L2)
CO 2	Summarize the functions of satellite space segment, earth segment, Multiple access techniques and satellite services. (Understand-L2)
CO 3	Illustrate the operational principles of satellite power system and space craft Control mechanism. (Understand-L2)
CO 4	Apply the fundamental concepts of orbital mechanics & satellite communication and its application (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	2	-	-	2	-	-	-	-	-	-	1	3	1
CO2	3	2	1	-	2	1	1	-	-	-	-	1	3	2
CO3	3	2	2	1	2	-	-	-	-	-	-	1	3	2
CO4	3	3	2	2	2	1	1	-	-	-	-	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).

TEXT BOOKS:

- T1** Timothy Pratt, Charles Bostian, Jeremy Allnutt, “Satellite communications”, John Wiley & Sons, 2nd edition, 2003.
T2 Dennis Roddy, “Satellite communications”, Tata McGraw Hills, 4th Edition, 2009.

REFERENCE BOOKS:

- R1** M. Richharia, “Satellite Communications Systems: Design principles”, BS Publications, 2nd Edition, 2005.
R2 D.C Agarwal, “Satellite communications”, Khanna Publications, 5th Edition, 2006.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Satellite Systems

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.	Course Objectives	1	29-06-2026		TLM1	
2.	Brief introduction about the course and its importance.	1	30-06-2026		TLM1	
3.	Need of space communication,	1	04-07-2026		TLM1	
4.	General Structure of satellite Communication system- (Flipped Classroom)	1	06-07-2026		TLM2	
5.	Types of Spacecraft Orbits, Launch vehicles.	1	07-07-2026		TLM1	
6.	Satellite subsystems and their functions – structure.	1	11-07-2026		TLM2	
7.	Satellite subsystems and their functions – thermal mechanisms.	1	13-07-2026		TLM2	
8.	Satellite subsystems and their functions – power, propulsion.	1	14-07-2026		TLM2	
9.	Satellite subsystems and their functions – Guidance and control.	1	18-07-2026		TLM1	
10.	Satellite subsystems and their functions – bus electronics.	1	20-07-2026		TLM1	
11.	Communication bands- characteristics and applications. (Peer Teaching and Collaborative Learning)	1	21-07-2026		TLM2	
12.	Revision of I Unit		25-07-2026		TLM1	
No. of classes required to complete UNIT-I:12				No. of classes taken:		

UNIT-II: Orbital Mechanics and satellite launching

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.	Fundamentals of Orbital Dynamics – Kepler 's laws.	1	27-07-2026		TLM1	
2.	Fundamentals of Orbital Dynamics – Kepler's laws	1	28-07-2026		TLM1	
3.	Orbital parameters	1	01-08-2026		TLM2	
4.	Orbital parameters		03-08-2026		TLM2	
5.	Problems	1	04-08-2026		TLM1	
6.	Orbital Perturbations	1	08-08-2026		TLM2	
7.	Orbital Perturbations (Blended Learning)		10-08-2026		TLM2	
8.	Need for station keeping.(Simulation using NASA Eyes on the Solar System)	1	11-08-2026		TLM2	
9.	Orbital effect	1	15-08-2026		TLM1	
10.	Launch Vehicles (Visual		17-08-2026		TLM2	

	Thinking Tools)					
11.	Reusable Launch Vehicles.	1	18-08-2026		TLM2	
12.	Revision of II Unit		22-08-2026		TLM1	
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: Power System and Bus Electronics

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 Panels: Silicon and Ga-As Cells.	1	31-08-2026		TLM2	
2.	Power generation capacity, efficiency.	1	01-09-2026		TLM2	
3.	Space Battery System Battery Types	1	01-09-2026		TLM2	
4.	Characteristics efficiency Parameters	1	07-09-2026		TLM1	
5.	Power electronics.	1	08-09-2026		TLM2	
6.	Telemetry of satellite	1	12-09-2026		TLM2	
7.	Command Control	1	14-09-2026		TLM2	
8.	monitoring functions (Interactive Quizzes & Polls)	1	15-09-2026		TLM2	
9.	Control Functions	1	19-09-2026		TLM1	
No. of classes required to complete UNIT-III: 09				No. of classes taken:		

UNIT-IV : Spacecraft Control:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Control Requirements: Attitude Control	1	21-09-2026		TLM1	
2.	Station keeping functions,	1	22-09-2026		TLM1	
3.	Type of control maneuvers.	1	26-09-2026		TLM1	
4.	Stabilization Schemes: Spin stabilization.	1	28-09-2026		TLM2	
5.	Stabilization Schemes: gravity gradient method, 3 axis stabilization.	1	29-09-2026		TLM2	
6.	Control Systems: Mass expulsion systems.- Flipped Classroom	1	03-10-2026		TLM2	
7.	Control Systems: Momentum exchange systems.	1	05-10-2026		TLM1	
8.	Gyro and Magnetic Torque - sensors, Star and sun sensor, Earth sensor. (Blended Learning Approach)	1	06-10-2026		TLM2	
9.	Magnetometers and Inertial Sensors.	1	10-10-2026		TLM2	
No. of classes required to complete UNIT-IV: 09				No. of classes taken:		

UNIT-V : Satellite services 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.	Introduction to Satellite services and applications	1	12-10-2026		TLM2	

2.	GPS location and principle.	1	13-10-2026		TLM2
3.	Direct to Home, Home receiver- Interactive Quizzes	1	17-10-2026		TLM2
4.	Satellite Mobile Services: VSAT. RADARSAT.	1	26-10-2026		TLM2
5.	IRNSS constellation.(Visual Learning)	1	27-10-2026		TLM2
6.	Satellite structures and materials.	1	31-10-2026		TLM2
No. of classes required to complete UNIT-V: 06				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.	Information about NaviC & some recently launched satellites information.	1	31-10-2026		TLM2	

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

PART-C

EVALUATION PROCESS (R23 Regulations):

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 (Units III, IV & V)	A2 = 5
II-Descriptive Examination (Units III, IV & V)	M2 = 15
II-Quiz Examination (Units 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)	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 public health and safety, and cultural, societal, and environmental considerations.
PO 4	Conduct Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO 7	Environment and Sustainability: Understand the impact of professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for, sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics, responsibilities, and norms of engineering practice.
PO 9	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams and multidisciplinary settings.
PO 10	Communication: Communicate effectively on complex engineering activities with the engineering community and society at large by preparing effective reports, design documentation, making effective presentations, and giving and receiving clear instructions.
PO 11	Project Management and Finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects 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
V V Ramakrishna

Course Coordinator
V V Ramakrishna

Module Coordinator
Dr.M.Venkata Sudhakar

HOD
Dr.G.Srinivasulu



LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC with 'A' grade & NBA (Under Tier - I), ISO 9001:2015 Certified Institution

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

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

Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. P. Lovaraju / Mr. I. Dakshina Murthy

Course Name & Code : Aerodynamics Lab-23AE55

Regulation: R23

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

Credits: 1.5

Program/Sem/Sec : B.Tech/V-SEM

A.Y.: 2026-2027

Course Educational Objectives:

To learn basic experiments in wind tunnel, open jet facility and basic flow visualization techniques.

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

CO1: To analyze the flow characteristics over aerodynamic bodies (Analyze-L4)

CO2: To analyze nozzle flow characteristics (Analyze-L4)

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

COs	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PO	PSO	PSO
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	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):

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-A			BATCH-B			
1.	Introduction	03	29-06-2026		01-07-2026		TLM4	
2.	Exp No 1	03	06-07-2026		08-07-2026		TLM4	
3.	Exp No 2	03	13-07-2026		15-07-2026		TLM4	
4.	Exp No 3	03	20-07-2026		22-07-2026		TLM4	
5.	Exp No 4	03	27-07-2026		29-07-2026		TLM4	
6.	Exp No 5	03	03-08-2026		05-08-2026		TLM4	
7.	Repeat	03	10-08-2026		12-08-2026		TLM4	

8.	Exp No 6	03	17-08-2026		19-08-2026		TLM4
9.	Exp No 7	03	31-08-2026		02-09-2026		TLM4
10.	Exp No 8	03	07-09-2026		09-09-2026		TLM4
11.	Exp No 9	03	21-09-2026		16-09-2026		TLM4
12.	Exp No 10	03	28-09-2026		23-09-2026		TLM4
13.	Repeat	03	05-10-2026		30-09-2026		TLM4
14.	Repeat	03	-----		06-10-2026		TLM4
15.	Internal Exam	03	12-10-2026		13-10-2026		---
No. of classes required to complete: Batch A: 14 Batch B: 15						No. of classes taken: Batch A: ___ Batch B: ___	

Students - Batch A: 24761A5601 to 16, 24761A5618 to 24761A5621 & 24761A5623 to 24761A5636 (34 Members)
Students - Batch B: 24761A5637 to 45, 24761A5647 to 55, 24761A5657 to 66, & 25765A5601 to 06 (34 Members)

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

PART-C

Evaluation Process (R23 Regulations):

Evaluation Task	Expt. no's	Marks
Day to Day work = A	1,2,3,4,5,6,7.....	A=10
Record = B	1,2,3,4,5,6,7.....	B=05
Internal Test = C	1,2,3,4,5,6,7.....	C = 15
Cumulative Internal Examination: A + B + C	1,2,3,4,5,6,7.....	30
Semester End Examinations = D	1,2,3,4,5,6,7.....	D = 70
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7.....	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
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PO 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	Dr. P. Lovaraju	Dr. P. Lovaraju



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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: S.Indrasena Reddy/ Nazumuddin Shaik

Course Name & Code : Aircraft Component Modelling Using CATIA & 23AE56 Regulation: R23

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

Credits: 1.5

Program/Sem/Sec : B.Tech/V

A.Y.: 2026-27

Course Educational Objective: To provide hands-on training in CATIA software for modelling of aircraft components.

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

COs	Statements	Blooms Level
CO1	Create, modify, and constrain 2D sketches for component design	Apply
CO2	Develop 3D models and assemble various aircraft components using CATIA	Apply

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	-	-	3	-	-	-	2	-	-	2	3	3
CO2	3	2	-	-	3	-	-		2	-	-	2	3	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)

23AE56- COMPONENT MODELLING USING CATIA

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	HOD Sign Weekly
1.	CATIA Introduction	3	30-06-26		
2.	Design of basic 2D sketches	3	07-07-26		
3.	Modelling of basic 3D parts	3	14-07-26		
4.	Design of aircraft wing structural elements	3	21-07-26		
5.	Design of aircraft fuselage structural elements	3	28-07-26		
6.	Modelling of landing gear components	3	04-08-26		
7.	Modelling of jet engine components	3	11-08-26		
8.	Drafting of conventional aircraft components	3	18-08-26		
9.	Assembly of a knuckle joint	3	01-09-26		
10.	Assembly of a radial engine	3	08-09-26		
11.	Assembly of wing elements	3	15-09-26		
12.	Assembly of fuselage components	3	22-09-26		
13.	Assembly of landing gear system	3	29-09-26		
14.	Assembly of jet engine components	3	06-10-26		
15.	Repetition Lab	3	13-10-26		
16.	Internal Test	3	27-10-26		

No. of classes required to complete: 16

PART-C

EVALUATION PROCESS (R23 Regulations):

Evaluation Task	Marks
Day to Day work = A	A=10
Record = B	B=05
Internal Test = C	C = 15
Cumulative Internal Examination : A + B + C	30
Semester End Examinations = D	D = 70
Total Marks: A + B + C + D	100

PART-D

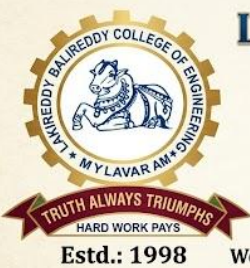
PROGRAMME OUTCOMES (POs):

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the 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
Name of the Faculty	(S.Indrasena Reddy)	(S.Indrasena Reddy)	(Dr.P.Lovaraju)
Signature			



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DEPARTMENT OF AEROSPACE ENGINEERING

Estd.: 1998

Website: <http://www.lbrce.ac.in/ase/index.php> Email: hodaero@lbrce.ac.in Phone: 08659-222933 Ext: 624/623

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. Nazumuddin Shaik/ Mr. G. V. Surya Narayana

Course Name & Code : Computational Structural Analysis Lab-23AES3

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

Credits: 2

Program/Sem/Sec : B. Tech, V-Sem

A.Y.: 2026-27

COURSE EDUCATIONAL OBJECTIVE (CEO): To provide hands-on training in using ANSYS for finite element analysis (FEA) on behavior of aerospace and mechanical structural components under various static and dynamic loading conditions.

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

COs	Statements	Blooms Level
CO1	Perform static structural analysis on beams, trusses, and other structural elements using FEA tools.	Apply
CO2	Analyze aircraft structural components for deformation, stress distribution, and failure criteria.	Analyze

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	2	3	-	-	-	-	-	-	3	3	3
CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3
			1 - Low			2 - Medium			3 - High					

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

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

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

S. No.	Topics to be covered (Experiment Name)	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.	Fundamentals of Finite Element Analysis (FEA)	29-06-2026		01-07-2026		TLM4	
2.	ANSYS Workbench and APDL environment	06-07-2026		08-07-2026		TLM4	
3.	Problem-solving strategy using FEA, Units, boundary conditions, Creating	13-07-2026		15-07-2026		TLM4	

S. No.	Topics to be covered (Experiment Name)	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			
	and modifying geometry using Design Modeler						
4.	Sketching tools and part modelling concepts, Solid modelling strategies for structural components	20-07-2026		22-07-2026		TLM4	
5.	Geometry simplification and repair for FEA, Pre and post processing basics	27-07-2026		29-07-2026		TLM4	
6.	Static structural analysis	03-08-2026		05-08-2026		TLM4	
7.	Modal and buckling analysis	10-08-2026		12-08-2026		TLM4	
8.	Introduction to dynamic analysis Brief overview of nonlinear analysis and its applications	17-08-2026		19-08-2026		TLM4	
9.	STRUCTURAL ANALYSIS OF AIRCRAFT COMPONENTS: Wing sections, Fuselage panels,	31-08-2026		02-09-2026		TLM4	
10.	Landing gear elements Analysis of composite structures.	07-09-2026		09-09-2026		TLM4	
11.	ANSYS Parametric Design Language	14-09-2026		16-09-2026		TLM4	
12.	Material modeling for metallic and composite structures.	21-09-2026		23-09-2026		TLM4	
13.	Composite structures Solving and results Analysis	28-09-2026		30-09-2026		TLM4	
14.	Project work Support	05-10-2026		07-10-2026		TLM4	
15.	Project work Support	12-10-2026		14-10-2026		TLM4	
16.	Internal Exam	26-10-2026		28-10-2026			

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

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work = A	1,2,3,4,5,6,7,8,9,10.	A=10
Record = B	1,2,3,4,5,6,7,8,9,10.	B=05
Internal Test = C	1,2,3,4,5,6,7,8,9,10.	C = 15
Cumulative Internal Examination: A + B + C = 30	1,2,3,4,5,6,7,8,9,10.	30
Semester End Examinations = D	1,2,3,4,5,6,7,8,9,10.	D = 70
Total Marks: A + B + C + D = 100	1,2,3,4,5,6,7,8,9,10.	100

PART-D

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

PO 1	Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
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PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations

Signature			
Name of the Faculty	Mr. Nazumuddin Shaik	Mr. Nazumuddin Shaik	Dr. P. Lovaraju
Title	Course Instructor	Module Coordinator	Head of the Department



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 NBA under Tier - I, Accredited by NAAC
An ISO 21001:2018, 500001:2018, 14001:2015 Certified Institution

DEPARTMENT OF AEROSPACE ENGINEERING

Estd.: 1998 Website: <https://www.lbrce.ac.in/ase/index.php> Email: hodaero@lbrce.ac.in Phone:08659-222933 Ext:624/623

COURSE HANDOUT

Name of Course Instructor: Mrs. K. S. L. LAVANYA/Mrs. B. UDAYALAKSHMI

Course Name & Code : TINKERING LAB & 23EM01

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

Credits: 1

Program/Sem/Sec : B.Tech/V

A.Y.: 2026-27

Course Educational Objectives (CEO): The aim of tinkering lab for engineering students is to provide a hands-on learning environment where students can explore, experiment, and innovate by building and testing prototypes. These labs are designed to demonstrate practical skills that complement theoretical knowledge.

Course Outcomes (COs): At the end of the course - students will be able to:

CO1: Turn ideas into reality by brainstorming, modelling and prototyping. (**Applying-L3**)

CO2: Inculcate innovative and entrepreneurial mind –set through Design thinking and Hands –on-Learning (**Applying-L3**)

CO3: Develop basic knowledge in electrical and mechanical engineering principles. (**Apply-L3**)

CO4: Develop skills of using hand tools to construct a prototype of an engineering design. (Applying L3)

CO-PO Mapping:

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	3	3	2	2	1	1	-	1	-	-	1	-	2
CO2	2	3	3	2	2	1	1	-	1	-	-	1	-	2
CO3	2	3	3	2	2	1	1	-	1	-	-	1	-	2
CO4	2	3	3	2	2	1	1	-	1	-	-	1		2

List of Experiments:

- 1) Make your own parallel and series circuits using breadboard for any application of your choice.
- 2) Demonstrate a traffic light circuit using breadboard.
- 3) Build and demonstrate automatic Street Light using LDR.
- 4) Simulate the Arduino LED blinking activity in Tinkercad.
- 5) Build and demonstrate an Arduino LED blinking activity using Arduino IDE.
- 6) Interfacing IR Sensor and Servo Motor with Arduino.
- 7) Blink LED using ESP32.
- 8) LDR Interfacing with ESP32.
- 9) Control an LED using Mobile App.
- 10) Design and 3D print a Walking Robot
- 11) Design and 3D Print a Rocket.
- 12) Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.
- 13) Demonstrate all the steps in design thinking to redesign a motor bike.

Students need to refer to the following links:

- 1) <https://aim.gov.in/pdf/equipment-manual-pdf.pdf>
- 2) <https://atl.aim.gov.in/ATL-Equipment-Manual/>
- 3) <https://aim.gov.in/pdf/Level-1.pdf>
- 4) <https://aim.gov.in/pdf/Level-2.pdf>
- 5) <https://aim.gov.in/pdf/Level-3.pdf>

COURSE DELIVERY PLAN (LESSON PLAN):
SECTION-A SCHEDULE

DAY: Saturday

Week/ H.T. Nos	I	II	III	IV	V	VI	VII	VII 1	IX	X	XI	XII	XIV	XV	XVII
Tentative date	04/7	11/ 7	18/ 7	25/ 7	01/0 8	8/ 8	22/ 8	5/ 9	12/ 9	19/ 9	26/ 9	3/1 0	10/1 0	17/1 0	31/1 0
Actual date															
	Dem o	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	REVISION	INTERNAL EXAM

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	29-06-2026	22-08-2026	8 W
I Mid Examinations	24-08-2026	29-08-2026	1 W
II Phase of Instructions	31-08-2026	17-10-2026	7 W
II Mid Examinations	02-11-2026	07-11-2026	1 W
Preparation and Practicals	09-11-2026	14-11-2026	1 W
Semester End Examinations	16-11-2026	28-11-2026	2 W

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 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.
PO 5	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.
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 the Aerospace vehicle design.
PSO 2	To prepare the students to work effectively in Aerospace and Allied Engineering organizations.

Course Instructors	Course Coordinator	Module Coordinator	HOD
Mrs. K. S. L. Lavanya B.Udayalakshmi	Mrs. K. S. L. Lavanya	Dr. G. Nageswara Rao	Dr. P. Sobha Rani