LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Affiliated to JNTUK, Kakinada & Approved by AICTE New Delhi,
Accredited by NAAC , An ISO 9001:2015 Certified Institution
L.B.Reddy Nagar, Mylavaram – 521 230, Krishna District, Andhra Pradesh, INDIA
Department of Aerospace Engineering
Website: http://lbrce.ac.in Email: hodaero@lbrce.ac.in Phone:08659-222933 Ext:513/515

COURSE HANDOUT

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

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : PROPULSION-II (17AE16)

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : **DIVVELA RAKESH**

COURSE COORDINATOR : DIVVELA RAKESH

PRE-REQUISITE: Propulsion-I

COURSE EDUCATIONAL OBJECTIVES (CEOs):

To learn the engineering concepts of ramjet and scramjet, The basic concepts of rocket propulsion, Working principle of liquid and solid propellant rocket systems, and advanced propulsion techniques.

COURSE OUTCOMES (COs)

After completion of the course, the student will be able to

CO1	Demonstrate the working principles of ramjet and scram jet engine. (Understand – L2)
CO2	Comprehend the preliminary concepts of rocket propulsion (Understand – L2)
CO3	Describe the working of various liquid propellant rocket systems (Understand – L2)
CO4	Access the use of solid propellant rocket systems (Apply-L4)
CO5	Apply the advanced rocket propulsion techniques for a mission (Apply - L3)

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

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

1. Sutton G.P, "Rocket Propulsion Elements" John Wiley Sons Inc, New York 5th Edn, 1993.

REFERENCES

1. Mattingly J.D, Elements of Propulsion: Gas Turbines and Rockets, AIAA Educational series.
2. Gorden C.V, Aero Thermodynamics of Gas Turbine and Rocket Propulsion, AIAA Educational series, New York,1989.
3. Yahya S.M, Fundamentals of Compressible fluid flows: SI units with Aircraft and Rocket Propulsion, New Age International,2003

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: RAMJET PROPULSION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Ram jet Propulsion Introduction	1	21-02-2022		TLM1	CO1	T1	
2.	Operating Principle	1	22-02-2022		TLM1 & TLM2	CO1	T1	
3.	Critical, Sub critical and Super critical operations	1	25-02-2022		TLM1	CO1	T1	
4.	Combustion in Ramjet	1	26-02-2022		TLM1 & TLM2	CO1	T1	
5.	Ram jet Performance	1	28-02-2022		TLM1	CO1	T1	
6.	Need of Supersonic combustion	1	01-03-2022		TLM1	CO1	T1	
7.	Components and working principle of scram jet engine	1	04-03-2022		TLM1	CO1	T1	
8.	Isolators and Types of combustion chambers for Scram jet engine	1	05-03-2022		TLM1	CO1	T1	
9.	Mixing Process in Scram jet engine	1	07-03-2022		TLM1	CO1	T1	
10.	Revision	1	08-03-2022					
No. of classes required to complete UNIT-I		10	11-03-2022		No. of classes taken:			

UNIT-II : ROCKET PROPULSION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
11.	Operating Principle	1	12-03-2022		TLM1 & TLM2	CO2	T1	
12.	Effective Exhaust velocity	1	14-03-2022		TLM2	CO2	T2	
13.	Thrust Equation	1	15-03-2022		TLM1 & TLM2	CO2	T2	
14.	Specific Impulse	1	18-03-2022		TLM	CO2	T2	
15.	Rocket Propulsion Requirements	1	19-03-2022		TLM2	CO2	T2	

16.	Equation of Motion for an Accelerating Flight	1	21-03-2022		TLM2	CO2	T2	
17.	MultiStage Rocket	1	22-03-2022		TLM2	CO2	T1	
18.	Revision	1	25-03-2022					
No. of classes required to complete UNIT-II		8	26-03-2022		No. of classes taken:			

UNIT-III: LIQUID PROPELLANT ROCKET

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
19.	Introduction	1	28-03-2022		TLM1 & TLM2	CO3	T1	
20.	Liquid Propellant Fuels and Oxidizers	2	29-03-2022 01-04-2022		TLM1	CO3	T1	
21.	Liquid Propellant Selection Properties	2	02-04-2022 04-04-2022		TLM1 & TLM2	CO3	T1	
22.	Propellant tanks	1	05-04-2022		TLM1 & TLM2	CO3	T1	
23.	Tank Pressurization	2	08-04-2022 09-04-2022		TLM2	CO3	T1	
24.	Turbo Pump Feed Systems	1	11-04-2022		TLM2	CO3	T1	
25.	Gas Pressure Feed Systems	1	12-04-2022		TLM2	CO3	T1	
26.	Injector Configurations	1	15-04-2022		TLM2	CO3	T1	
27.	Combustion Process	1	16-04-2022		TLM2	CO3	T1	
28.	Combustion Instabilities	1	18-04-2022		TLM2	CO3	T1	
29.	Revision	1	19-04-2022					
No. of classes required to complete UNIT-III		14			No. of classes taken:			

UNIT-IV: SOLID PROPELLANT ROCKET

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
30.	Solid Propellant rockets	1	22-04-2022		TLM1 & TLM2	CO4	T1	
31.	Double base and Composite Propellants	2	23-04-2022 25-04-2022		TLM2	CO4	T1	

32.	Selection Criteria for Solid Propellants	2	26-04-2022 29-04-2022		TLM2	CO4	T1	
33.	Combustion Process	1	30-04-2022		TLM2	CO4	T1	
34.	Propellant Burn Rate	1	02-05-2022		TLM2	CO4	T1	
35.	Propellant Grain and Its Configuration	2	03-05-2022 06-05-2022		TLM1 & TLM2	CO4	T1	
36.	Propellant Grain Stress and Strain	2	07-05-2022 09-05-2022		TLM1 & TLM2	CO4	T1	
37.	Hybrid Rockets	1	10-05-2022		TLM2	CO4	T1	
38.	Revision	1	13-05-2022					
No. of classes required to complete UNIT-IV		13			No. of classes taken:			

UNIT-V : ADAVANCED PROPULSION TECHNIQUES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
39.	Electrical Propulsion Systems	1	14-05-2022		TLM1 & TLM2	CO5	T1	
40.	Electro Thermal Systems	1	16-05-2022		TLM2	CO5	T1	
41.	Pulse jet, Arc Jet	1	17-05-2022		TLM2	CO5	T1	
42.	Electro Static Systems	1	20-05-2022		TLM2	CO5	T1	
43.	Ion Propulsion Techniques	1	21-05-2022		TLM2	CO5	T1	
44.	Electro Magnetic Systems	1	23-05-2022		TLM1 & TLM2	CO5	T1	
45.	Pulsed Plasma Thruster	1	24-05-2022		TLM1 & TLM2	CO5	T1	
46.	Magneto Plasma Dynamic Thruster	1	27-05-2022		TLM1 & TLM2	CO5	T1	
47.	Solar Sail	1	28-05-2022		TLM2	CO5	T1	
48.	Nozzleless Propulsion	1	30-05-2022		TLM2	CO5	T1	
49.	Energy Spike	1	31-05-2022		TLM1	CO5	T1	
50.	Nuclear Rockets	1	03-06-2022		TLM3	CO5	T1	
51.	Revision	1	04-06-2022					
No. of classes required to complete UNIT-V		13			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:

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems.

PEO2: To train students with good scientific and engineering breadth to comprehend, analyze, design, and create novel products and solutions for the real-life problems

PEO3: 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)

PO1: To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: To identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: To 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: To 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: To 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 limitations.

PO6: To 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: To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9: To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: To 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: To 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.

DIVVELA RAKESH	DIVVELA RAKESH	Dr. P. LOVARAJU
Course Instructor	Course Coordinator	HOD

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Nazumuddin Shaik
Course Name & Code : 17AE17-**AIRCRAFT STRUCTURES – II**
L-T-P Structure : 3-2-0 Credits : 3
Program/Sem/Sec : B.Tech., VI-Sem. A.Y: 2021-22

PRE-REQUISITE: Strength of Materials and Aircraft Structures – I

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of the course is to enable the students to apply standard methods to calculate the stress and displacement of thin walled symmetrical and unsymmetrical components located in fuselage, wing and landing gear are subjected to static loads.

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

CO 1	Assess the behaviour of beam structures subjected to different loading conditions (Apply-L3)
CO 2	Estimate the shear flow distribution and location of shear centre for open sections (Apply-L3)
CO 3	Determine the shear flow distribution and location of shear centre in closed section beams (Apply-L3)
CO 4	Formulate the relations for thin plates subjected to bending and buckling loads (Apply-L3)
CO 5	Analyze the behaviour of bending and shear flow over aircraft wing and fuselage cross-sections (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	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

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 Peery. D. J, Azar. J. J, Aircraft Structures, Second Edition, McGraw–Hill, New York, 2007.
T2 Megson, T. H. G, Aircraft Structures for Engineering Students, Sixth Edition, Elsevier 2017.

REFERENCE BOOKS:

R1 Bruhn. E. F. Analysis and Design of Flight Vehicles Structures, S. r. Jacobs, 1973.
R2 Rivello. R. M, Theory and Analysis of Flight Structures, McGraw-Hill, 1993.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: BENDING STRESS

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	22-02-2022			
2.	Introduction to Unit-I	1	02-01-1900		**TLM1&2**	
3.	Introduction - Principal Axis	1	25-02-2022		**TLM1&2**	
4.	Neutral Axis Methods	1	26-02-2022		**TLM1&2**	
5.	Bending Stresses- Beams of Symmetric Sections Symmetric Loads	1	02-03-2022		**TLM1&2**	
6.	Beams of Symmetric Sections with Skew Loads	1	04-03-2022		**TLM1&2**	
7.	**TUTORIAL-1**	1	05-03-2022		**TLM3**	
8.	Unsymmetrical Sections with Symmetric Loads.	1	08-03-2022		**TLM1&2**	
9.	Unsymmetrical Sections with Symmetric Loads.	1	09-03-2022		**TLM1&2**	
10.	Unsymmetrical Sections with Skew Loads.	1	11-03-2022		**TLM1&2**	
11.	Unsymmetrical Sections with Skew Loads	1	15-03-2022		**TLM1&2**	
12.	Problems	1	16-03-2022		**TLM1**	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: SHEAR FLOW IN OPEN SECTIONS

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 Unit-II	1	19-03-2022		**TLM1&2**	
2.	Thin Walled Beams Shear Flow	1	22-03-2022		**TLM1&2**	
3.	Concept of Shear Flow	1	23-03-2022		**TLM1&2**	
4.	Shear Centre	1	25-03-2022		**TLM1&2**	
5.	Shear Flow in Open-Section	1	26-03-2022		**TLM1&2**	
6.	**TUTORIAL-2**	1	29-03-2022		**TLM3**	
7.	Shear Flow in Open-Section Symmetrical	1	30-03-2022		**TLM1&2**	
8.	Shear Flow in Open-Section Symmetrical	1	01-04-2022		**TLM1&2**	
9.	Shear Flow in Open-Section Unsymmetrical	1	05-04-2022		**TLM1&2**	
10.	Shear Flow in Open-Section Unsymmetrical	1	06-04-2022		**TLM1&2**	
11.	Problems	1	08-04-2022		**TLM1&2**	
No. of classes required to complete UNIT-II:11				No. of classes taken:		

UNIT-III: SHEAR FLOW IN CLOSED SECTIONS

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 Unit-III	1	19-04-2022		**TLM1&2**	
2.	Bredt–Batho Theory	1	20-04-2022		**TLM1&2**	
3.	Shear Flow in Closed-Section	1	22-04-2022		**TLM1&2**	

4.	Single Cell –Shear Flow	1	23-04-2022		**TLM1&2**	
5.	Multi-Cell –Shear Flow	1	26-04-2022		**TLM1&2**	
6.	Shear Centre	1	27-04-2022		**TLM1&2**	
7.	**TUTORIAL-3**	1	29-04-2022		**TLM3**	
8.	Shear Centre & Torsion	1	30-04-2022		**TLM1&2**	
9.	Thin Wall Bending with skin Effective	1	03-05-2022		**TLM1&2**	
10.	Thin Wall Bending with skin Ineffective	1	04-05-2022		**TLM1&2**	
11.	Problems	1	06-05-2022		**TLM1&2**	
No. of classes required to complete UNIT-III:11				No. of classes taken:		

UNIT-IV : BENDING & BUCKLING OF THIN PLATES

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 Unit-IV	1	07-05-2022		**TLM1&2**	
2.	Plates Subjected to Pure Bending and Twisting	1	10-05-2022		**TLM1&2**	
3.	Plates Subjected to Distributed and Transverse Load	1	11-05-2022		**TLM1&2**	
4.	In-Plane Loading	1	13-05-2022		**TLM1&2**	
5.	Thin Rectangular Plate with Small Initial Curvature.	1	17-05-2022		**TLM1&2**	
6.	**TUTORIAL-4**	1	18-05-2022		**TLM3**	
7.	Introduction to Inelastic buckling of plates	1	20-05-2022		**TLM1&2**	
8.	Determination of critical load for a flat plate	1	21-05-2022		**TLM1&2**	
9.	Local instability, Instability of stiffened panels	1	24-05-2022		**TLM1&2**	
10.	Failure stress in plates and stiffened panels	1	25-05-2022		**TLM1&2**	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V : STRESS ANALYSIS IN WING AND FUSELAGE

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 Unit-V	1	27-05-2022		**TLM1&2**	
2.	Study of Wing Spars and Box Beams	1	28-05-2022		**TLM1&2**	
3.	Shear Resistant Web Beams	1	31-05-2022		**TLM1&2**	
4.	Tension Field Web Beams (Wagner's)	1	01-06-2022		**TLM1&2**	
5.	**TUTORIAL-5**	1	03-06-2022		**TLM3**	
6.	Procedures to Find Shear stress Distribution for Cantilever Beam.	1	04-06-2022		**TLM1&2**	
7.	Procedures to Bending Moment Distribution for Cantilever Beam.	1	04-06-2022		**TLM1&2**	
No. of classes required to complete UNIT-V:07				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 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
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
Mr. Nazumuddin Shaik	Dr. L. Prabhu	Dr.P. Lovaraju

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PROGRAM : **B.Tech., VI-Sem., ASE**

ACADEMIC YEAR : **2021-22**

COURSE NAME & CODE : **Flight Dynamics and 17AE18**

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

COURSE CREDITS : **3**

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

COURSE COORDINATOR : **Dr. P. Lovaraju**

PRE-REQUISITE: Engineering Mechanics, Aerodynamics, Propulsion

Course Educational Objectives: To learn the concepts of performance estimation on steady level flight at various altitudes and velocities, performance of maneuvering flight at unaccelerated and accelerated conditions, the concepts of static stability requirements during flight, the basic concepts of dynamic stability and control of an aircraft.

CO 1	Determine thrust and power requirement conditions for steady level flight (Apply-L3)
CO 2	Estimate performance parameters of flight during manoeuvring (Apply-L3)
CO 3	Apply the conditions of static stability and control in the aircraft design (Apply-L3)
CO 4	Understand various concepts and conditions of static stability and control (Understand -L2)
CO5	Apply the concepts and conditions of dynamic control methods during flight (Apply-L3)

Course Code	COs	Programme Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
17AE18	CO1	3	3	3	2	-	-	-	-	-	-	-	3	3	2
	CO2	3	3	3	3	-	-	-	-	-	-	-	3	3	3
	CO3	3	2	3	3	-	-	-	-	-	-	-	3	3	3
	CO4	3	3	3	2	-	-	-	-	-	-	-	3	3	3
	CO5	3	3	2	2	-	-	-	-	-	-	-	3	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).

BOS APPROVED TEXT BOOKS:

T1 Aircraft Performance and Design, J.D Anderson, Tata McGrawhill Edition

T2 Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 2004

BOS APPROVED REFERENCE BOOKS:

R1 Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son:, Inc, NY, 1988.

R2 Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, NY, 1982.

R3 Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.

R4 Michael V. Cook, "Flight Dynamics Principles", Second Edition, Elsevier Aerospace Engineering Series, 2007.

R5 Mc Cornick B. W, "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, NY, 1995.

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: STEADY FLIGHT PERFORMANCE

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to Course and discussion of course outcomes (Cos)	1	21-02-2022		**TLM1**	CO1	T1	
2.	Introduction to Aircraft Performance, Equations of motion of Steady level flight	1	22-02-2022		**TLM1**	CO1	T1	
3.	Drag Polar	1	23-02-2022		**TLM1**	CO1	T1	
4.	Thrust Required for Level Flight	2	24-02-2022 25-02-2022		**TLM1**	CO1	T1	
5.	Tutorial	1	28-02-2022		TLM3			
6.	Thrust Available and Maximum Velocity	2	2-03-2022 3-03-2022		**TLM1**	CO1	T1	
7.	Power required for level flight, Power available and maximum velocity	2	4-03-2022 7-03-2022		**TLM1**	CO1	T1	
8.	Altitude effects	1	8-03-2022		**TLM1**	CO1	T1	
9.	Effect of Drag Divergence	1	9-03-2022		**TLM1**	CO1	T1	
10.	Tutorial	1	10-03-2022		TLM3			
11.	Assignment-1/Quiz-1							
No. of classes required to complete UNIT-I:		13	No. of classes taken:					

UNIT-II: MANOEUVERING FLIGHT PERFORMANCE

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Rate of climb and climb performance parameter	2	11-03-2022 14-03-2022		**TLM1**	**CO2**	**T1**	
2.	Hodograph Diagram ,Absolute and service ceiling, Time to climb	2	15-03-2022 16-03-2022		**TLM1**	**CO2**	**T1**	
3.	Gliding Flight	1	17-03-2022		**TLM1**	**CO2**	**T1**	
4.	Tutorial	1	21-03-2022		TLM3			
5.	Range for propeller driven and jet propelled	2	22-03-2022 23-03-2022		**TLM1**	**CO2**	**T1**	
6.	Endurance, Endurance for propeller driven and jet propelled	2	24-03-2022 25-03-2022		**TLM1**	**CO2**	**T1**	
7.	Tutorial	1	28-03-2022		TLM3			
8.	Pull-Up and Pull-Down Manoeuvres	1	29-03-2022		**TLM1**	**CO2**	**T1**	
9.	Turning Flight, Constraints on load factor	1	30-03-2022		**TLM1**	**CO2**	**T1**	

10.	V-n diagram	2	31-03-2022 1-04-2022		**TLM1**	**CO2**	**T1**	
11.	Take-off performance	1	4-04-2022		**TLM1**	**CO2**	**T1**	
12.	Landing performance	1	6-04-2022		**TLM1**	**CO2**	**T1**	
13.	Revision	2	7-04-2022 8-04-2022		TLM2			
14.	Assignment-2/Quiz-2							
No. of classes required to complete UNIT-II:		19	No. of classes taken:					

I MID EXAMINATIONS (11-04-2022 TO 19-04-2022)

UNIT-III: STATIC LONGITUDINAL STABILITY AND CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction, Moments on the airplane, Absolute angle of attack	1	20-4-2022		TLM2	CO3	T2	
2.	Criteria for longitudinal Stability	1	21-4-2022		TLM2	CO3	T2	
3.	Wing contribution for longitudinal static stability	2	22-04-2022 25-04-2022		TLM2	CO3	T2	
4.	Tail contribution for longitudinal static stability	2	26-04-2022 27-04-2022		TLM2	CO3	T2	

5.	Tutorial	1	28-04-2022		TLM3			
6.	Total pitching moment, Neutral point , Static margin	1	22-4-2022		**TLM1**	CO3	T2	
7.	Stick fixed stability, Stick free stability, Longitudinal control	1	25-4-2022		**TLM1**	CO3	T2	
8.	Elevator angle to trim, Elevator hinge moment	2	26-04-2022 27-04-2022		**TLM1**	CO3	T2	
9.	Power effects	1	28-04-2022		TLM1	CO3	T2	
10.	Tutorial	1	29-04-2022		TLM3			
11.	Assignment-3/Quiz 3							
No. of classes required to complete UNIT-III:		13	No. of classes taken:					

UNIT-IV : STATIC LATERAL-DIRECTIONAL STABILITY AND CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Lateral stability-Dihedral effect, criterion for lateral stability	1	2-05-2022		**TLM1**	CO4	T2	
2.	Dihedral effect, Adverse yaw effects	1	4-05-2022		**TLM1**	CO4	T2	
3.	Contribution of wing, fuselage, tail, Lateral control - Coupling	1	5-05-2022		**TLM1**	CO4	T2	

	between rolling and yawing moments							
4.	Lateral control-strip theory estimation of aileron effectiveness, aileron reversal.	1	6-05-2022		**TLM1**	CO4	T2	
5.	Directional stability-yaw and sideslip, Criterion of directional stability, Contribution wing, fuselage, tail	1	9-05-2022		**TLM1**	CO4	T2	
6.	Tutorial	1	10-05-2022		TLM3			
7.	Directional control- rudder control effectiveness	1	11-05-2022		**TLM1**	CO4	T2	
8.	Rudder requirements-adverse yaw, asymmetric power condition, spin recovery	1	12-05-2022		**TLM1**	CO4	T2	
9.	Rudder lock and Dorsal fin	1	13-05-2022		**TLM1**	CO4	T2	
10.	Tutorial	1	16-05-2022		TLM3			
11.	Assignment-4/Quiz 4							
No. of classes required to complete UNIT-IV:		10	No. of classes taken:					

UNIT-V : DYNAMIC STABILITY AND CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to dynamic longitudinal stability, Modes of stability	1	17-05-2022		**TLM1**	CO5	T2, R1	
2.	Aircraft Equations of motion	2	18-05-2022 19-05-2022		**TLM1**	CO5	T2, R1	
3.	Small disturbance theory	2	20-05-2022 23-05-2022		**TLM1**	CO5	T2, R1	
4.	Solving the stability quartic, Routh's Discriminant	1	24-05-2022		TLM1	CO5	T2, R1	
5.	Tutorial	1	25-05-2022		TLM3			
6.	Phugoid motion, Short period of oscillation	1	26-05-2022		**TLM1**	CO5	T2, R1	
7.	Brief description of lateral and directional dynamic stability	2	27-05-2022 30-05-2022		**TLM1**	CO5	T2, R1	
8.	Spiral divergence, Dutch roll, auto rotation and spin	1	31-05-2022		**TLM1**	CO5	T2, R1	
9.	Tutorial	1	1-06-2022		TLM3			
10.	Assignment-5/Quiz 5							
11.	Revision	2	2-06-2022 3-06-2022		TLM2			
No. of classes required to complete UNIT-V:12		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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	21-02-2022	9-04-2022	7W
I Mid Examinations	11-04-2022	16-04-2022	1W
II Phase of Instructions	18-04-2022	04-06-2022	7W
II Mid Examinations	06-06-2022	11-06-2022	1W
Preparation and Practical	13-06-2022	18-06-2022	1W
Semester End Examinations	20-06-2022	02-07-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=5
Assignment/Quiz – 2	2	A2=5
I-Mid Examination	1,2	B1=20
I-Mid Examination(Objective)	1,2	C1=10
Assignment/Quiz – 3	3	A3=5
Assignment/Quiz – 4	4	A4=5
Assignment/Quiz – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
II-Mid Examination(Objective)	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Evaluation of Quiz Marks: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3,4,5	C=10

Attendance Marks: D(>95%=5, 90-95%=4,85-90%=3,80-85%=2,75-80%=1)		D=5
Cumulative Internal Examination : A+B+C+D	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

Program Educational Objectives (PEO)

PEOs	Statement
PEO1	To provide students with sound mathematical, engineering and multidisciplinary knowledge to solve Aerospace and Allied Engineering problems
PEO2	To prepare students to excel in higher education programs and to succeed in industry/academia profession.
PEO3	To inculcate ethical attitude, leadership qualities, problem solving abilities and life-long learning for a successful professional career

PROGRAM OUTCOMES (POs)

PO1: To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

PO2: To identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: To 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: To 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: To 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 limitations.

PO6: To 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: To understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO8: To apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO9: To function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10: To communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11: To 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: To 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**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : L. Prabhu
Course Name & Code : FEME & 17AE19
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., VI-Sem. A.Y : 2021-22

Pre-requisites: Numerical Methods, Strength of Materials

Course Educational Objectives: To understand the concepts such as discretization, natural coordinates, interpolation functions, stiffness matrix etc, the concepts of axisymmetric solids subjected to axisymmetric loading and the importance of isoparametric elements, the steady state heat transfer through plane walls and fin, the Eigen value and Eigen vectors for dynamic problems.

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

CO 1	Identify mathematical model for solution of common engineering problems
CO 2	Determine the design quantities (deformation, strain, stress) for engineering structures under different loading conditions
CO 3	Formulate the design and heat transfer problems with application of FEM.
CO 4	Create new solutions for the existing problems using FEM approaches
CO 5	Evaluate the natural frequencies of bar and beam structures

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	3
CO2	3	3		1									3	3
CO3	3	2	2	2									3	3
CO4	3	3	2	3									3	3
CO5	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).

TEXT BOOKS:

T1 Chandraputla, Ashok, Belegundu., Introduction to Finite Elements in Engineering, 3rd edition, 5th impress, Prentice – Hall, 2008..
T2 Rao.S.S, The Finite Element Methods in Engineering, 4th edition, 6th reprint, B.H. Pergamon, 2010.

REFERENCE BOOKS:

R1 Reddy.J.N, An introduction to Finite Element Method, 3rd edition, 13th reprint, McGraw Hill, 2011.
R2 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
R3 David Hutton., Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005
R4 George R Buchanan, R.RudraMoorthy., Finite Element Analysis, Tata McGraw Hill, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION TO FINITE ELEMENT METHODS & ONE 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
1.	Introduction to FEM	1	21-02-2022		TLM2	
2.	Equilibrium equations	1	23-02-2022		TLM2	
3.	Stresses and equilibrium	1	24-02-2022		TLM2	
4.	Strain displacement relations, Stress strain relations	1	25-02-2022		TLM2	
5.	Plane stress and plane strain problems	1	28-02-2022		TLM2	
6.	Potential energy and equilibrium method	1	02-03-2022		TLM2	
7.	FE Formulation from governing differential equations	1	03-03-2022		TLM2	
8.	Weighted residual methods	1	04-03-2022		TLM2	
9.	One dimensional problem, FE Modeling, 1-D bar problems	1	07-03-2022		TLM2	
10.	Shape functions & coordinates of shape functions	1	09-03-2022		TLM2	
11.	Assembly of GSM & Load vector	1	10-03-2022		TLM2	
12.	Finite element equations and treatment of boundary conditions	1	11-03-2022		TLM2	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: ANALYSIS OF 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
1.	Analysis of Beams: Beam elements	1	14-03-2022		TLM2	
2.	Types loading, DOF, BC's	1	16-03-2022		TLM2	
3.	Hermite shape functions	1	17-03-2022		TLM2	
4.	Element Stiffness matrix	1	21-03-2022		TLM2	
5.	Load vector, Boundary conditions	1	23-03-2022		TLM2	
6.	Two dimensional elements (CST)	1	24-03-2022		TLM2	
7.	CST problems	1	25-03-2022		TLM2	
8.	Shape functions, Stiffness matrix,	1	28-03-2022		TLM2	
9.	Strain-Displacement matrix	1	30-03-2022		TLM2	
10.	Force terms	1	31-03-2022		TLM2	
No. of classes required to complete UNIT-II:10				No. of classes taken:		

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
1.	Axisymmetric solids	1	18-04-2022		TLM2	
2.	Finite element modeling	1	20-04-2022		TLM2	
3.	Axisymmetric loading with triangular elements	1	21-04-2022		TLM2	
4.	Axisymmetric Problems	1	22-04-2022		TLM2	
5.	2-D four nodded isoparametric elements	1	25-04-2022		TLM2	
6.	Jacobian, shape functions	1	27-04-2022		TLM2	
7.	4- node quadrilateral element	1	28-04-2022		TLM2	

8.	Numerical integration	1	29-04-2022		TLM2	
9.	Gauss Quadrature	1	02-05-2022		TLM2	
No. of classes required to complete UNIT-III:09				No. of classes taken:		

UNIT-IV: 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
1.	Heat conduction in plane walls	1	04-05-2022		TLM2	
2.	convection heat transfers in fins	1	05-05-2022		TLM2	
3.	Two dimensional analysis of thin plate with triangular elements	1	06-05-2022		TLM2	
4.	analysis of thin plate with triangular elements	1	09-05-2022		TLM2	
5.	Heat convection through fins	1	11-05-2022		TLM2	
6.	Fin Problems	1	12-05-2022		TLM2	
7.	Element conductivity matrix	1	13-05-2022		TLM2	
8.	Convection matrix	1	16-05-2022		TLM2	
9.	Heat rate vector	1	18-05-2022		TLM2	
No. of classes required to complete UNIT-IV:09				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
1.	Dynamic Analysis intro	1	19-05-2022		TLM2	
2.	Lumped mass matrices	1	20-05-2022		TLM2	
3.	consistent mass matrices	1	23-05-2022		TLM2	
4.	Problems	1	25-05-2022		TLM2	
5.	Evaluation of Eigen values	1	26-05-2022		TLM2	
6.	Evaluation of Eigen vectors	1	27-05-2022		TLM2	
7.	Evaluation of stepped bars	1	30-05-2022		TLM2	
8.	Stepped bars Problems	1	01-06-2022		TLM2	
9.	Stepped bars Problems	1	02-06-2022		TLM2	
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/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5

II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
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 the defense and space research programs

Course Instructor (L. Prabhu) | Course Coordinator | Module Coordinator (Dr.Prabhu.L) | HOD (Dr.P.Lovaraju)

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF AEROSPACE

COURSE HANDOUT

PART-A

Name of Course Instructor : Bhuvaneshwari M
Course Name & Code : SPACE MECHANICS –17AE23
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., VI-Sem., A.Y : 2021-22

PRE-REQUISITE : Basic astronomy knowledge

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the basic aspects of space and solar system. To learn satellite injections and orbit perturbations and also interplanetary trajectory issues. To learn ballistic missile trajectories and material used on spacecraft.

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

CO1	Understand basic aspects of space (Understand-L2)
CO2	Evaluate trajectory details of ballistic missiles (Apply -L3)
CO3	Apply N-body aspects in space exploration issues (Apply -L3)
CO4	Know the general aspects of satellite injections and orbit perturbations (Understand-L2)
CO5	Understand the interplanetary trajectories of spacecraft (Understand-L2)

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

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

BOS APPROVED TEXT BOOKS:

T1 W.E.Wiesel, Spaceflight Dynamics, McGraw-Hill,1997

T2 Cornelisse, Schoyer HFR, Wakker KF, Rocket Propulsion and Space Flight Dynamics, pitman publications, 1984

BOS APPROVED REFERENCE BOOKS:

R1 Van de Kamp, P., "Elements of Astro-mechanics", Pitman, 1979.

R2 Parker E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc.,1982.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: BASIC CONCEPTS

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	1	21/02/2022		**TLM1**	
2.	Reference frames and Coordinate systems	2	22/02/2022& 23/02/2022		**TLM1**	
3.	The celestial sphere, The ecliptic	1	26/02/2022		**TLM1**	
4.	Motion of vernal equinox	1	28/02/2022		**TLM2**	
5.	Time and calendar- sidereal time	1	02/03/2022		**TLM2**	
6.	Solar time and standard time	1	05/03/2022		**TLM1**	
7.	The Earth's atmosphere	2	07/03/2022& 08/03/2022		**TLM1**	
8.	Space environment	2	09/03/2022& 12/03/2022		**TLM2**	
No. of classes required to complete UNIT-I		11	No. of classes taken:			

UNIT-II: BALLISTIC MISSILE TRAJECTORIES

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.	The boost phase	1	14/03/2022		**TLM1**	
2.	The ballistic phase	2	15/03/2022& 16/03/2022		**TLM1**	
3.	Trajectory geometry	2	19/03/2022& 21/03/2022		**TLM1**	
4.	Optimal flights	2	22/03/2022& 26/03/2022		**TLM1**	
5.	Time of flight	2	28/03/2022& 29/03/2022		**TLM1**	
6.	The re-entry phase- position of impact point	1	30/03/2022		**TLM1**	
7.	Spherical earth, oblate earth	2	04/04/2022		**TLM1**	
8.	Influence coefficients	2	06/04/2022& 09/04/2022		**TLM1**	
No. of classes required to complete UNIT - II		14	No. of classes taken:			

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.	General N-body problem	1	18/04/2022		**TLM1**	
2.	The circular restricted three body problem	1	19/04/2022		**TLM1**	
3.	Jacobi's integral	1	20/04/2022		**TLM1**	
4.	Libration points	1	23/04/2022		**TLM1**	
5.	Applications to space flight	1	25/04/2022		**TLM1**	
6.	Relative motion in the N-body problem – Satellite orbit perturbations	1	26/04/2022		**TLM1**	
7.	The two-body problem	1	27/04/2022		**TLM1**	
8.	circular, elliptic, parabolic, and hyperbolic orbits	1	30/04/2022		**TLM1**	
9.	Orbital elements	1	02/05/2022		**TLM1**	
No. of classes required to complete UNIT - III		9	No. of classes taken:			

UNIT - III: THE MANY BODY PROBLEMS

UNIT - IV: SATELITE LAUCHING AND ORBIT PERTUBATIONS

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 – Types of orbits	1	04/05/2022		**TLM1**	
2.	Launch vehicle ascent trajectories	1	07/05/2022		**TLM1**	
3.	General aspects of Satellite injection	1	09/05/2022		**TLM1**	
4.	Launch vehicle performances	1	10/05/2022		**TLM1**	
5.	Orbit deviations	1	11/05/2022		**TLM1**	
6.	Special and general perturbations	1	14/05/2022		**TLM1**	
7.	Cowell's method	1	16/05/2022		**TLM1**	
8.	Encke's method	1	17/05/2022		**TLM1**	
9.	Method of variation of orbital elements and General perturbations approach	1	18/05/2022		**TLM1**	
No. of classes required to complete UNIT - IV		9	No. of classes taken:			

UNIT – V: INTERPLANETARY TRAJECTORIES

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.	Two dimensional interplanetary trajectories	1	21/05/2022		**TLM1**	
2.	Hohmann trajectories	2	23/05/2022& 24/05/2022		**TLM1**	
3.	Fast interplanetary trajectories	1	25/05/2022		**TLM1**	
4.	Launch opportunities	1	28/05/2022		**TLM1**	
5.	Three dimensional interplanetary trajectories	1	30/05/2022		**TLM1**	
6.	The launch of interplanetary spacecraft	1	31/05/2022		**TLM1**	
7.	Trajectory about target planet	2	01/06/2022& 04/06/2022		**TLM1**	
No. of classes required to complete UNIT-V		9	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 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

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 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.

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
(Ms.M.Bhuvaneshwari)	(Dr.P.Lovaraju)	(Dr.P.Lovaraju)

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

Part-A

PROGRAM : B.Tech. VI-Sem.

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : Propulsion Lab - 17AE64

L-T-P STRUCTURE : 0-0-2

COURSE CREDITS 1

COURSE INSTRUCTORS : Mr.D.Rakesh / Ms.M.Bhuvaneshwari

COURSE COORDINATOR : Mr.D.Rakesh

PRE-REQUISITE: General knowledge about engines

COURSE EDUCATIONAL OBJECTIVES: To learn the various basic experiments related to components of jet engines and piston engines.

COURSE OUTCOMES (COs)

After completion of the course, the student will be able

CO1	Analyze the performance of various jet engines components (Analyze-L4)
CO2	Analyze the performance of piston engine components (Analyze-L4)

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

PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
3	3	2	3	-	-	-	-	-	-	-	3	3	3
3	3	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).

REFERENCE BOOKS:

R1 V Ganesan, Gas Turbines, Third Edition, McGraw–Hill, New Delhi, 2010

R2 Jack D Mattingly, Elements of Gas Turbine Propulsion, Sixth Edition, McGraw-Hill, New Delhi, 2013

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Batch A

S.No	Tentative Date of Completion	Actual Date of Completion	Topics to be covered / List of Experiments		Learning Outcome COs
1	22/02/2022 & 01/03/2022			Lab Demo	
2	08/03/2022		Exp-1	Performance characteristics of five stage axial flow compressor	CO1
3	15/03/2022		Exp-2	Free jet characteristics	CO2
4	22/03/2022		Exp-3	Cascade testing of compressor blade row	CO1
5	29/03/2022		Exp-4	Wall jet characteristics	CO1
6	05/04/2022		Exp-5	Cascade testing of turbine blade row	CO1
7	12/04/2022			Repetition Lab	
8	19/04/2022		Exp-6	Free convective heat transfer rate over an airfoil	CO2
9	26/04/2022		Exp-7	Study of properties of solid propellant	CO1
10	03/05/2022		Exp-8	Forced convective heat transfer rate over an airfoil	CO2
11	10/05/2022		Exp-9	Study of an aircraft piston engine (includes study of assembly of sub systems, various components, their functions, and operating principles)	CO2
12	17/05/2022		Exp-10	Performance evaluation of thrust produced by propeller	CO2
13	24/05/2022			Repetition Lab	
14	31/05/2022			Internal Exam	

COURSE DELIVERY PLAN (LESSON PLAN): Batch B

S.No	Tentative Date of Completion	Actual Date of Completion	Topics to be covered / List of Experiments		Learning Outcome COs
1	24/02/2022			Lab Demo	CO1
2	03/03/2022		Exp-1	Performance characteristics of five stage axial flow compressor	CO1
3	10/03/2022		Exp-2	Free jet characteristics	CO2
4	17/03/2022		Exp-3	Cascade testing of compressor blade row	CO1
5	24/03/2022		Exp-4	Wall jet characteristics	CO1
6	31/03/2022		Exp-5	Cascade testing of turbine blade row	CO1
7	07/04/2022			Repetition Lab	
8	21/04/2022		Exp-6	Free convective heat transfer rate over an airfoil	CO2
9	28/04/2022		Exp-7	Study of properties of solid propellant	CO1
10	05/05/2022		Exp-8	Forced convective heat transfer rate over an airfoil	CO2
11	12/05/2022		Exp-9	Study of an aircraft piston engine (includes study of assembly of sub systems, various components, their functions, and operating principles)	CO2
12	19/05/2022		Exp-10	Performance evaluation of thrust produced by propeller	CO2
13	26/05/2022			Repetition Lab	
14	31/05/2022			Internal Exam	

Part - C

EVALUATION PROCESS:

Parameter		Marks
Day – to – Day Work	Observation	A1 = 10 Marks
	Record	A2 = 10 Marks
Internal Test		B =10 Marks
Attendance		C = 05 Marks
Viva – Voce During Regular Lab Sessions		D = 05 Marks
Cumulative Internal Examination		**A1+ A2 + B+C+D = 40 Marks**
Semester End Examinations		**E = 60 Marks**
Total Marks: A1+ A2 + B + C + D + E		**100 Marks**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Program Educational Objectives (PEO)

PEO1: To provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems.

PEO2: To train students with good scientific and engineering breadth so as to comprehend, analyze, design, and create novel products and solutions for the real life problems.

PEO3: 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.

PROGRAM OUTCOMES (POs):

Engineering Graduated 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.

Mr. D. Rakesh	Dr.P.Lovaraju	Dr.P.Lovaraju
Course Instructor	Module Coordinator	HOD

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT
Part-A

PROGRAM : B.Tech. VI-Sem.

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : Aircraft Structures Lab-17AE65

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

COURSE CREDITS : 3

COURSE INSTRUCTORS : Mr. Nazumuddin Shaik, Mr.S. Indrasena Reddy and Mr. Ashutosh Shukla

PRE-REQUISITE: Strength of Materials Lab

COURSE EDUCATIONAL OBJECTIVES (CEOs):

To understand various principles and theorems involved in the theory of aircraft structures, vibrations and experimental analysis by doing simple and advanced experiments and analyzing the results.

COURSE OUTCOMES (COs)

After completion of the course, the student will be able to

CO1	Analyze beam structures subjected to different loading conditions (Analyze-L4)
CO2	Analyze deflection based on different theories of aircraft structure (Analyze-L4)
CO3	Analyze the performance of cams, governors and gyroscope (Analyze-L4)

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	3	2	3	-	-	-	-	-	-	-	3	3	3
CO2	2	3	2	3	-	-	-	-	-	-	-	3	3	3
CO3	2	3	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).

REFERENCE BOOKS:

R1 Megson, T. H. G, Aircraft Structures for Engineering Students, Sixth Edition, Elsevier 2017

R2 Peery. D. J, Azar. J. J, Aircraft Structures, Second Edition, McGraw–Hill, New York, 2007.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Batch A

S.No	Tentative Date of Completion	Actual Date of Completion	Topics to be covered / List of Experiments		Learning Outcome COs
1	22-02-2022			Lab Demo	CO1
2	08-03-2022		Exp-1	Compression Test of Columns.	CO1
3	15-03-2022		Exp-2	Verification of Maxwell's Reciprocal Theorem.	CO2
4	22-03-2022		Exp-3	Watt and Porter Governor	CO3
5	29-03-2022		Exp-4	Determine gyroscopic couple using Gyroscope	CO3
6	19-04-2022		Exp-5	Verification of Castigliano's theorem	CO2
7				Repetition Lab	
8	26-04-2022		Exp-6	Unsymmetrical Bending of a Cantilever Beam (C, Z, L and T-Sections).	CO1
9	10-05-2022		Exp-7	Determination of Shear Center of Open Section (C, Z and T-Sections).	CO1
10	17-05-2022		Exp-8	Determination of Beam Deflection (C, Z, L and T-Sections).	CO1
11	24-05-2022		Exp-9	Wagner Beam-Tension Field Beam.	CO2
12	31-05-2022		Exp-10	Non Destructive Test-Dye Penetration Test and Magnetic Particle Detection.	CO2
13				Composite Laminate preparation and testing.	CO1&CO2
14				Repetition Lab Internal Exam	

Contents beyond the Syllabus:

15			Landing Gear	CO1 & CO2
16			Wing	CO1& CO2

COURSE DELIVERY PLAN (LESSON PLAN): Batch B

S.No	Tentative Date of Completion	Actual Date of Completion	Topics to be covered / List of Experiments		Learning Outcome COs
1	24-02-2022			Lab Demo	CO1
2	03-03-2022		Exp-1	Compression Test of Columns.	CO1
3	10-03-2022		Exp-2	Verification of Maxwell's Reciprocal Theorem.	CO2
4	17-03-2022		Exp-3	Watt and Porter Governor	CO3
5	24-03-2022		Exp-4	Determine gyroscopic couple using Gyroscope	CO3
6	31-03-2022		Exp-5	Verification of Castigliano's theorem	CO2
7	07-04-2022			Repetition Lab	
8	21-04-2022		Exp-6	Unsymmetrical Bending of a Cantilever Beam (C, Z, L and T-Sections).	CO1
9	28-04-2022		Exp-7	Determination of Shear Center of Open Section (C, Z and T-Sections).	CO1
10	05-05-2022		Exp-8	Determination of Beam Deflection (C, Z, L and T-Sections).	CO1
11	12-05-2022		Exp-9	Wagner Beam-Tension Field Beam.	CO2
12	19-05-2022		Exp-10	Non Destructive Test-Dye Penetration Test and Magnetic Particle Detection.	CO2
13	26-05-2022			Composite Laminate preparation and testing.	CO1&CO2
14				Repetition Lab	
	02-06-2022			Internal Exam	

Contents beyond the Syllabus:

15			Landing Gear	CO1 & CO2
16			Wing	CO1& CO2

Part - C

EVALUATION PROCESS:

Parameter		Marks
Day – to – Day Work	Observation	A1 = 10 Marks
	Record	A2 = 10 Marks
Internal Test		B =10 Marks
Attendance		C = 05 Marks
Viva – Voce During Regular Lab Sessions		D = 05 Marks
Cumulative Internal Examination		**A1+ A2 + B+C+D = 40 Marks**
Semester End Examinations		**E = 60 Marks**
Total Marks: A1+ A2 + B + C + D + E		**100 Marks**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Program Educational Objectives (PEO)

PEO1 : To provide students with sound mathematical, engineering and multidisciplinary knowledge to solve Aerospace and Allied Engineering problems

PEO2 : To prepare students to excel in higher education programs and to succeed in industry/academia profession.

PEO3: To inculcate ethical attitude, leadership qualities, problem solving abilities and life-long learning for a successful professional career

PROGRAM OUTCOMES (POs):	
Engineering Graduated 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)	
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

Mr. Nazumuddin Shaik	Dr.L.Prabhu	Dr.P.Lovaraju
Course Instructor	Module Coordinator	HOD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
L.B.Reddy Nagar, Mylavaram – 521 230.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: http://lbrce.ac.in **Email:** hodaero@lbrce.ac.in **Phone:08659-222933 Ext:513/515**

COURSE HANDOUT

PART-A

Course Name & Code : **Mini Project- 17PD04**
L-T-P Structure : 0-0-4 Credits : 2
Program/Sem/Sec : B.Tech., VI-Sem. A.Y : 2021-22

COURSE EDUCATIONAL OBJECTIVES:

The objective of this mini project is to let the students apply the aerospace knowledge into a real- world situation/problem.

COURSE OUTCOMES:

After completion of the course students are able to:

CO1:	Apply the basic domain specific engineering concepts (Apply -L3)
CO2:	Demonstrate the basic domain specific engineering concepts through working models (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	3	2	-	3	-	-	3	3	2	3	3	3	3
CO2	3	3	2	-	3	-	-	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

Week wise Schedule till Review-I

S. No	Roll No.	Date
1.	19761A2101	26-02-2022
2.	19761A2102	
3.	19761A2103	
4.	19761A2104	
5.	19761A2105	
6.	19761A2106	
7.	19761A2108	
8.	19761A2109	05-03-2022
9.	19761A2110	
10.	19761A2111	
11.	19761A2113	
12.	19761A2114	
13.	19761A2115	
14.	19761A2116	
15.	19761A2117	12-03-2022
16.	19761A2118	
17.	19761A2119	
18.	19761A2120	
19.	19761A2121	
20.	19761A2122	
21.	19761A2123	
22.	19761A2124	19-03-2022
23.	19761A2125	
24.	19761A2126	
25.	19761A2127	
26.	19761A2128	
27.	19761A2129	
28.	19761A2130	

S. No	Roll No.	Date
29.	19761A2131	26-03-2022
30.	19761A2132	
31.	19761A2133	
32.	19761A2134	
33.	19761A2135	
34.	19761A2136	
35.	19761A2137	
36.	19761A2138	02-04-2022
37.	19761A2139	
38.	19761A2140	
39.	19761A2141	
40.	19761A2143	
41.	19761A2144	
42.	19761A2146	09-04-2022
43.	19761A2147	
44.	19761A2148	
45.	19761A2149	
46.	20765A2101	
47.	20765A2102	
48.	20765A2103	
49.	20765A2104	
50.	20765A2105	
51.	20765A2106	
52.	20765A2107	
53.	20765A2108	

Week wise Schedule till Review-II

S. No	Roll No.	Date
1.	19761A2101	23-04-2022
2.	19761A2102	
3.	19761A2103	
4.	19761A2104	
5.	19761A2105	
6.	19761A2106	
7.	19761A2108	
8.	19761A2109	30-04-2022
9.	19761A2110	
10.	19761A2111	
11.	19761A2113	
12.	19761A2114	
13.	19761A2115	
14.	19761A2116	
15.	19761A2117	07-05-2022
16.	19761A2118	
17.	19761A2119	
18.	19761A2120	
19.	19761A2121	
20.	19761A2122	
21.	19761A2123	
22.	19761A2124	14-05-2022
23.	19761A2125	
24.	19761A2126	
25.	19761A2127	
26.	19761A2128	
27.	19761A2129	
28.	19761A2130	

S. No	Roll No.	Date
29.	19761A2131	21-05-2022
30.	19761A2132	
31.	19761A2133	
32.	19761A2134	
33.	19761A2135	
34.	19761A2136	
35.	19761A2137	
36.	19761A2138	28-05-2022
37.	19761A2139	
38.	19761A2140	
39.	19761A2141	
40.	19761A2143	
41.	19761A2144	
42.	19761A2146	04-06-2022
43.	19761A2147	
44.	19761A2148	
45.	19761A2149	
46.	20765A2101	
47.	20765A2102	
48.	20765A2103	
49.	20765A2104	
50.	20765A2105	
51.	20765A2106	
52.	20765A2107	
53.	20765A2108	

PART-C

EVALUATION PROCESS (R19 Regulations):

Evaluation Task	**Marks**
Review-II	100
Review-II	100
Total Marks = Average of Review-I & Review-II	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	Individual and 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.
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Course Instructor's/Project Guides	Module Coordinator	HOD
Mr. G V Surya Narayana/ Project Guides	Dr. P. Lovaraju	Dr. P. Lovaraju