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
PART-A

Name of Course Instructor : **S.Indrasena Reddy**
Course Name & Code : MOC & 20AE22
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., VII-Sem. A.Y : 2025-26

PRE-REQUISITE: Strength of materials

COURSE EDUCATIONAL OBJECTIVES (CEOs): To Learn the basic knowledge about composite materials at micro and macro level, lamina and laminates, basic design concepts of sandwich panels, functionally graded materials and the manufacturing process of composite materials.

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

CO 1	Understand stress-strain relations of orthotropic materials [Understand L2]
CO 2	Analyze properties of composite lamina at micro level and macro level [Analyze-L4]
CO 3	Analyze characteristics of layered composites [Analyze-L4]
CO 4	Understand the nomenclature of sandwich structures [Understand-L2]
CO 5	Apply techniques of fabrication processes to manufacture composites[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**	**3**	**2**								**2**	**3**	**2**
CO2	**3**	**3**	**3**	**2**								**2**	**3**	**2**
CO3	**3**	**3**	**3**	**2**								**2**	**3**	**2**
CO4	**3**	**3**	**3**	**2**								**2**	**3**	**2**
CO5	**2**	**2**	**2**	**2**								**2**	**2**	**2**

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

TEXT BOOKS:

T1 Calcote, LR., "The Analysis of laminated Composite Structures", Von – Noastrand Reinhold Company, New York 1998.
T2 Jones, R.M., "Mechanics of Composite Materials", 2nd Edition McGraw-Hill, KogakushaLtd.,Tokyo, 1998.
T3 Carlsson, L.A., Kardomateas, G.A., "Structural and Failure Mechanics of Sandwich", Solid Mechanics and its Applications, Vol 121, Springer Heidlberg, New York, 2011.

REFERENCE BOOKS:

R1 Agarwal, B.D., Broutman, L.J., "Analysis and Performance of Fibre Composites", John Wiley and sons. Inc., New York, 1995
R2 Lubin, G., "Handbook on Advanced Plastics and Fibre Glass", Von Nostrand Reinhold Co.,New York, 1989.Publishers,3rd edition 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: STRESS STRAIN RELATION

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 Composite materials	1	01-07-25		TLM1	
2.	Role of Reinforcement and Matrix	1	03-07-25		TLM1	
3.	Classification of composites	1	04-07-25		TLM1	
4.	Properties of Fibers	1	05-07-25		TLM1	
5.	Types of matrix and their applications	1	08-07-25		TLM1	
6.	Advantages and applications	1	10-07-25		TLM1	
7.	Aerospace Applications	1	11-07-25		TLM1	
8.	Other Applications	1	15-07-25		TLM1	
9.	Generalized Hooke's Law	1	17-07-25		TLM1	
10.	Stress strain relations for non-isotropic materials	1	18-07-25		TLM1	
11.	Stress strain relations for orthotropic materials	1	19-07-25		TLM1	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: METHODS OF 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.	Introduction to macro mechanics	1	22-07-25		TLM1	
2.	Stress-strain relation of orthotropic Lamina on-axis	1	24-07-25		TLM1	
3.	Stress-strain relation of orthotropic Lamina Arbitory orientation	1	25-07-25		TLM1	
4.	Material properties of Lamina	1	29-07-25		TLM1	
5.	Experimental characterization	1	31-07-25		TLM3	
6.	Introduction to micro mechanics	1	01-08-25		TLM1	
7.	Mechanics of materials approach	1	02-08-25		TLM1	
8.	Determine Four Elastic constants	1	05-08-25		TLM1	
9.	Problems on Lamina Elastic Constants	1	07-08-25		TLM3	
10.	Elasticity approach to materials	1	08-08-25		TLM1	
11.	Bounding Techniques	1	12-08-25		TLM1	
No. of classes required to complete UNIT-II:11				No. of classes taken:		

UNIT-III: MULTI DIRCTIONAL COMPOSITES

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 laminate	1	14-08-25		TLM1	
2.	Macromechanics of Laminate	1	19-08-25		TLM1	
3.	Types of Laminates and Notations	1	21-08-25		TLM1	
4.	Equilibrium equations for laminate	1	22-08-25		TLM1	
5.	Stress strain variation in Laminate	1	23-08-25		TLM1	
6.	Classical Laminate Theory	1	07-10-25		TLM1	
7.	Analysis of Symmetric laminate	1	09-10-25		TLM3	
8.	A,B, D matrices Cross ply laminates	1	10-10-25		TLM1	

9.	A,B, D matrices angle ply laminates	1	14-10-25		TLM1	
10.	Failure criteria of laminates	1	16-10-25		TLM1	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV: SANDWICH CONSTRUCTIONS

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 sandwich panels	1	17-10-25		TLM1	
2.	Design concepts of sandwich panels	1	18-10-25		TLM1	
3.	Facing/Skin, core Materials	1	23-10-25		TLM1	
4.	Flexural rigidity of sandwich with same face thickness	1	24-10-25		TLM1	
5.	Deflection of sandwich beams	1	25-10-25		TLM1	
6.	Problems on sandwich beams	1	28-10-25		TLM1	
7.	Problems on sandwich panels	1	30-10-25		TLM3	
8.	Applications of Sandwich panels	1	31-10-25		TLM1	
9.	Failure modes of sandwich panels	1	01-11-25		TLM1	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

UNIT-V: FABRICATION PROCESSES & FUNCTIONALLY GRADED MATERIALS

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 fabrication process	1	04-11-25		TLM1	
2.	Fabrication of Carbon Fiber	1	06-11-25		TLM1	
3.	Fabrication of Boron, Glass Fiber	1	07-11-25		TLM1	
4.	Open and closed mould fabrication	1	11-11-25		TLM1	
5.	Hand Layup, Spray Layup process	1	13-11-25		TLM1	
6.	Vacuum bagging, infusion Process	1	14-11-25		TLM1	
7.	Pultrusion Process	1	15-11-25		TLM1	
8.	RTM, Auto Clave Process	1	18-11-25		TLM1	
9.	Filament Winding Process	1	20-11-25		TLM1	
10.	Introduction to FGM	1	21-11-25		TLM1	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

Advanced Topics/ beyond Syllabus in MOC

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.	Materials and Advanced Fabrication Techniques used in Aerospace	1	22-11-25		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 (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 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
(S.Indrasena Reddy)	(S.Indrasena Reddy)	(Dr.P.Lovaraju)

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 : Dr. A. Revanth Reddy
Course Name & Code : SVP & 20AE24
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., VII-Sem. A.Y : 2025-26

PRE-REQUISITE: Air-breathing Propulsion

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the engineering concepts of ramjet and scram jet, the basic aspects of rocket propulsion, working principle of liquid, and solid propellant rocket systems, and advance propulsion techniques.

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

CO 1	To understand the working of ramjet and scram jet engines [Understand L2]
CO 2	To evaluate the preliminary parameters of rocket propulsion. [Apply-L3]
CO 3	To understand the working of liquid and solid propellant rocket systems [Understand-L2]
CO 4	To apply the advanced rocket propulsion techniques for a mission [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	3	2								2	3	2
CO2	3	3	3	2								2	3	2
CO3	3	3	3	2								2	3	2
CO4	3	3	3	2								2	3	2

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

TEXT BOOKS:

T1 Sutton. G.P and Oscar Biblarz "Rocket Propulsion Elements", Wiley-Interscience,7th Edition., 2000.

T2 Mattingly. J. D, Elements of Propulsion: Gas Turbines and Rockets, AIAA Educational Series, 2017.

REFERENCE BOOKS:

R1 Gorden, C.O, Aero Thermodynamics of Gas Turbine and Rocket Propulsion, AIAA Education Series, New York, 1997.

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	HOD Sign Weekly
1.	Introduction to ramjet propulsion	1	01-07-25		TLM1	
2.	Operating principle of ramjets	1	02-07-25		TLM1	
3.	Critical mode of operation	1	04-07-25		TLM1	
4.	Sub-critical and Super-critical mode of operation	1	05-07-25		TLM1	
5.	Combustion process in ramjet engines	1	08-07-25		TLM1	
6.	Performance of Ramjets	1	09-07-25		TLM1	
7.	Performance of Ramjets and its current limitations	1	11-07-25		TLM1	
8.	Need for Supersonic combustion	1	12-07-25		TLM1	
9.	Components and working principle of a Supersonic Ramjet Engine	1	15-07-25		TLM1	
10.	Components and working principle of a Supersonic Ramjet Engine	1	16-07-25		TLM1	
11.	Isolators for SCRAMJET Engine	1	18-07-25		TLM1	
12.	Types of combustion chambers for Scramjet Engine	1	19-07-25		TLM1	
13.	Working principle behind the design of various combustion chambers	1	22-07-25		TLM1	
14.	Mixing process in SCRAMJET Combustion	1	23-07-25		TLM1	
No. of classes required to complete UNIT-I: 14				No. of classes taken: 14		

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	HOD Sign Weekly
15.	Introduction to Rocket propulsion	1	25-07-25		TLM1	
16.	Operating principles of different rockets	1	26-07-25		TLM1	
17.	Derivation of Effective exhaust velocity	1	29-07-25		TLM1	
18.	Derivation of Thrust equation	1	30-07-25		TLM1	
19.	Determination of Specific Impulse of a propellant combination	1	01-08-25		TLM1	
20.	Problems based on various performance parameters of rockets	1	02-08-25		TLM1	
21.	Problems based on various performance parameters of rockets	1	05-08-25		TLM1	
22.	Rocket Propulsion Requirements	1	06-08-25		TLM3	
23.	Derivation of equations of motion for an accelerating rocket	1	08-08-25		TLM1	
24.	Derivation of equations of motion for	1	09-08-25		TLM1	

	an accelerating rocket (Cont)					
25.	Multistage Rockets	1	12-08-25		TLM1	
26.	Problems based on Multistaging of rockets	1	13-08-25		TLM1	
No. of classes required to complete UNIT-II:12				No. of classes taken: 12		

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	HOD Sign Weekly
27.	Introduction to Liquid rockets	1	19-08-25		TLM1	
28.	Classification of Liquid propellant	1	20-08-25		TLM1	
29.	Types of fuels used and their properties	1	22-08-25		TLM1	
30.	Types of oxidizers used and their properties	1	23-08-25		TLM1	
31.	Design of the propellant tanks and their arrangements in the launch vehicles	1	30-09-25		TLM2	
32.	Need to pressurize the tanks for propellant delivery	1	01-10-25		TLM1	
33.	Introduction to the different types of feed systems	1	03-10-25		TLM2	
34.	Introduction to turbopump feed systems and engine cycles	1	04-10-25		TLM1	
35.	Open and closed engine cycles	1	07-10-25		TLM2	
36.	Introduction to Gas pressure feed systems	1	08-10-25		TLM1	
37.	Design of various gas pressure feed systems	1	10-10-25		TLM2	
38.	Introduction to injectors and their types	1	11-10-25		TLM1	
39.	Designs of various spray type injectors	1	14-10-25		TLM1	
40.	Designs of Jet type injectors	1	15-10-25		TLM2	
41.	Combustion process in a liquid rocket engine	1	17-10-25		TLM2	
42.	Introduction to combustion instabilities	1	18-10-25		TLM2	
43.	Methods to mitigate or eliminate the combustion instability	1	22-10-25		TLM1	
No. of classes required to complete UNIT-III:17				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	HOD Sign Weekly
44.	Introduction to Solid Propellant Rockets	1	24-10-25		TLM1	
45.	Classification of Solid propellants	1	25-09-25		TLM1	
46.	Composition of double base propellants.	1	28-10-25		TLM1	
47.	Composition of Composite propellants	1	29-10-25		TLM1	
48.	Selection criteria of solid propellants	1	31-10-25		TLM1	
49.	Combustion process of Solid propellants	1	01-11-25		TLM3	
50.	Propellant burning rate	1	04-11-25		TLM1	

51.	Problems based on Burning rate of solid propellants	1	05-11-25		TLM1	
52.	Propellant grains and its configurations	1	07-11-25		TLM1	
53.	Regression phenomenon of various grain designs	1	08-11-25		TLM1	
54.	Thrust profile of various grain designs	1	11-11-25		TLM1	
55.	Igniters used in Solid Rockets	1	11-11-25		TLM1	
56.	Ignition delay, action time and burning time	1	12-11-25		TLM1	
57.	Propellant grain stress and strain	1	12-11-25		TLM1	
58.	Hybrid rocket design and its performance	1	12-11-25		TLM1	
No. of classes required to complete UNIT-IV:15				No. of classes taken:		

UNIT-V: ADVANCED PROPULSION TECHNIQUES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
59.	Introduction to Advanced propulsion techniques	1	14-11-25		TLM1	
60.	Electro thermal Rocket design and working principle	1	15-11-25		TLM1	
61.	Working principle of Electrostatic engines	1	18-11-25		TLM1	
62.	Ion Propulsion techniques	1	18-11-25		TLM1	
63.	Working principle of Electro-magnetic thrusters	1	19-11-25		TLM1	
64.	Pulsed plasma thrusters and MPD thrusters	1	19-11-25		TLM1	
65.	Magneto Plasma Dynamic Thrusters	1	21-11-25		TLM1	
66.	Solar Sails	1	21-11-25		TLM1	
67.	Nozzleless propulsion	1	21-11-25		TLM1	
68.	Introduction to nuclear propulsion and its need	1	22-11-25		TLM1	
69.	Types of nuclear engine designs proposed	1	22-11-25		TLM1	
70.	Usage of Nuclear power in Inter planetary missions (MTGs)	1	22-11-25		TLM1	
No. of classes required to complete UNIT-V:12				No. of classes taken:		

Advanced Topics/ beyond Syllabus in MOC

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.	Recent advances in Electric propulsion	1	22-11-25		TLM2	
2.	Recent developments in 3D printed rocket engines	1	22-11-25		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 (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 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
(Dr. A Revanth Reddy)	(Dr. A Revanth Reddy)	(Dr.P.Lovaraju)

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

COURSE HANDOUT

PROGRAM : B. Tech, VII Sem, Aerospace Engineering
ACADEMIC YEAR : 2025-2026
COURSE NAME AND CODE : 20AE28-SPACE MECHANICS
L-T-P STRUCUTRE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : Dr. Sreenadh Chevula
COURSE COORDINAOTR : Dr. Sreenadh Chevula
PRE-REQISITE
Course educational objectives : To learn basic aspects of space and solar system, Satellite injection and its orbit perturbations, an interplanetary trajectory issues, ballistic missile trajectories and material used of spacecraft

COURSE OUTCOMES(Co's) At the end of the course students can be able to

CO1	Understand the basic aspects of space [Understand-L2]
CO2	Evaluate trajectory details of ballistic missiles [Analyze-L4]
CO3	Apply N-body aspects in space exploration issues [Apply-L3]
CO4	Know the general aspects of satellite injection and orbit perturbations [Understand-L2]
CO5	Evaluate interplanetary trajectories of spacecraft [Analyze-L4]

	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

BOS APPROVED TEXTBOOKS

T1 W.E. Wiesel, "Spaceflight Dynamics", McGraw-Hill, 1997
T2 Comelisse, Schoyer HFR, Wakker KF, "Rocket Propulsion and Space Flight Dynamics", Pitman publications, 1984
T3 Van de Kamp, P., "Elements of Astro-mechanics", Pitman, 1979.
T4 Parker E.R., "Materials for Missiles and Spacecraft", McGraw-Hill Book Co. Inc., 1982. Series, Published by AIAA, 2002
T5 Vladimir A. Chobotov, "Orbital Mechanics", AIAA Education Series, AIAA Education Series, AIAA Education Series, Published by AIAA, 2002

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT - I BASIC CONCEPTS

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
1	References Frames and Coordinate Systems	1	01-07-2025		2	CO1	T1&T2	
2	The celestial sphere,	2	2-07,3-07-2025		2	CO1	T1&T2	
3	The ecliptic, Motion of Vernal Equinox:	1	05-07-2025		2	CO1	T1&T2	
4	Time and calendar Sidereal Time	2	08,09-07-2025		2	CO1	T1&T2	
5	Solar Time, Standard time	1	10-07-2025		2	CO1	T1&T2	
6	The Earth's atmosphere	2	12-07-2025		2	CO1	T1&T2	
7	The space environment	1	15-07-2025		2	CO1	T1&T2	
Total No of classes required to complete Unit-1		10	No of Classes Taken :					

UNIT - II BALLISTIC MISSILE TRAJECTORIES

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
1	The Boost Phase: The Ballistic Phase	3	16-07-2025		2	CO2	T1&T2	
2	Trajectory Geometry, Optimal Flights	3	17,18,19-07-2025		2	CO2	T1&T2	
3	Time of Flight: The re-entry phase	3	22,23-07-2025		2	CO2	T1&T2	
4	The position of the impact point	4	24,25,29,30-07-2025		2	CO2	T1&T2	
5	Spherical earth, Oblate Earth, Influence Coefficients	4	30,31-07-2025		2	CO2	T1&T2	
Total No of classes required to complete Unit-II		17	No of Classes Taken :					

UNIT - III THE MANY- BODY PROBLEM

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
1	General N-body problem:	1	02-08-2025		2	CO3	T1&T2	
2	The Circular Restricted Three Body Problem	2	5.6-08-2025		2	CO3	T1&T2	
3	Jocob's integral, Libration Points	3	9,12-08-2025		2	CO3	T1&T2	
4	Applications to space flight:	3	14,19-08-2025		2	CO3	T1&T2	
5	Relative Motion in the N-body Problem	3	20-08-2025		2	CO3	T1&T2	
6	Satellite orbit perturbations	3	21,23-08-2025		2	CO3	T1&T2	

25-08-2025 to 20-09-2025 CRT (Technical Training)
22-09-2025 to 27-09-2025 MID-1 Examination

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
7	Two-Body Problem circular, elliptic	2	07,08-10-2025		2	CO3	T1&T2	
8	parabolic and hyperbolic orbits: Orbital Elements	2	09,11-10-2025		2	CO3	T1&T2	
Total No of classes required to complete Unit-III		19	No of Classes Taken :		2	CO3	T1&T2	

UNIT - IV SATELLITE LAUNCHING AND ORBIT PERTURBATIONS

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
1	Launch vehicle ascent trajectories:	1	14-10-2025		2	CO4	T1&T2	
2	Satellite Injection-General Aspects:	2	15,16-2025		2	CO4	T1&T2	
3	Launch vehicle performances: Orbit deviations:	2	18,22-10-2025		2	CO4	T1&T2	
4	Special and General Perturbations	2	23,25-10-2025		2	CO4	T1&T2	
5	Cowell's method, Ecke's method	2	28,29-10-2025		2	CO4	T1&T2	
6	method of variation of orbital elements	2	30-10-2025		2	CO4	T1&T2	
7	General Perturbations Approach	1	01-11-2025		2	CO4	T1&T2	
Total No of classes required to complete Unit-IV		12	No of Classes Taken :		2	CO4	T1&T2	

UNIT - V INTERPLANETARY TRAJECTORIES

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Act Date of completion	TLM method	Learning Outcomes	Textbook Followed	HoD Sign
1	Two Dimensional Interplanetary trajectories	1	04-11-2025		2	CO5	T1&T2	
2	Hohmann trajectories, Fast Interplanetary Trajectories	2	5,06-2025		2	CO5	T1&T2	
3	Launch opportunities:	2	8,11-11-2025		2	CO5	T1&T2	
4	Three Dimensional	2	12,13-11-2025		2	CO5	T1&T2	
5	Interplanetary Trajectories	3	15,18,19-11-2025		2	CO5	T1&T2	
6	Launch if interplanetary Spacecraft:	2	20,22-11-2025		2	CO5	T1&T2	
7	Trajectory about the Target Planet.	3	20,22-11-2025		2	CO5	T1&T2	
Total No of classes required to complete Unit-V		15	No of Classes Taken :		2	CO5	T1&T2	

24-11-2025 to 29-11-2025 MID-2 Examination
1-12-2025 to 06-12-2025 Preparation and Practical Examinations
8-12-2025 to 20-12-2025 Sem end examination

Teaching Learning Method	
TLM2	PPT and Chalk and Talk

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Approved by AICTE, New Delhi & Permanently Affiliated to JNTUK, Kakinada
Accredited by NAAC with "A" Grade and NBA (ECE, EEE, CSE, IT, MECH, CE & ASE) Under Tier-I
L B Reddy Nagar, Mylavaram-521 230, NTR District, Andhra Pradesh.

DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. P. Venkateswara Rao, Sr. Asst.Professor
Course Name & Code : Systems and signal Processing-20EC85 **Regulation**: R20
L-T-P Structure : 3-0-0 **Credits:** 03
Program/Sem/Sec : B. Tech. VII-Sem., Aerospace Engineering **A.Y.:** 2025-26

PRE-REQUISITE: Differentiation and Integration

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides basic knowledge on signals, operations, representation of signals in frequency domain using Fourier series, Fourier transform and Z transform. This course introduces underlying concepts of sampling & reconstruction, types of systems and filter design.

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

CO1	Discuss the classification of signals and systems along with their properties and the Concepts of sampling. **(Understand – L2)**
CO2	Apply the concepts of Fourier series, Fourier Transform and Z Transform on signals. **(Apply – L3)**
CO3	Describe the systems and observe the response of Linear Systems. **(Understand – L2)**
CO4	Design IIR Digital Filters by applying Approximation Procedures and FIR Digital Filters through Window Techniques. **(Apply – L3)**

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

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

TEXTBOOKS:

T1	A V Oppenheim, A S Wilsky and IT Young, "Signals and Systems", PHI/Pearson publishers, 2nd Edition.
T2	John G. Proakis, "Digital Signal Processing, Principles, Algorithms & Applications", Pearson education, Fourth edition, 2007

REFERENCE BOOKS:

R1	A.Anand Kumar, "Signals and Systems", 2nd Edition, PHI, 2012.
R2	B P Lathi, "Signals, Systems and Communications", BSP, 2003, 3rd Edition.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: Signal Analysis, Operations of Signals

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, Course Outcomes, Introduction to UNIT-I	1	30-06-2025		TLM1	
2.	**Signal analysis:** Concept of signal	1	01-07-2025		TLM1	
3.	Classification of Signals	1	02-07-2025		TLM1	
4.	Representation of elementary signals	1	04-07-2025		TLM1	
5.	**Operations on signals**: Time shifting and Time reversal operations	1	07-07-2025		TLM4	
6.	Time scaling and Amplitude scaling operations	1	08-07-2025		TLM1	
7.	Problems on operations on signals	1	09-07-2025		TLM1	
8.	**Properties of signals**: Even and Odd, Causal and Non causal signals	1	11-07-2025		TLM1	
9.	Bounded and unbounded signals, Periodic and aperiodic signals	1	14-07-2025		TLM1	
10.	Energy and power, Deterministic and random signals	1	15-07-2025		TLM1	
11.	**Activity:** Estimation of Energy and power of a signal using MATLAB	1	16-07-2025		TLM4	
12.	Revision	1	18-07-2025		TLM1	
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: Fourier series, Fourier Transform, Sampling Theorem

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	**Fourier Series:** Concept of Fourier Series	1	21-07-2025		TLM1	
14.	Trigonometric Fourier Series	1	22-07-2025		TLM1	
15.	Exponential Fourier Series	1	23-07-2025		TLM1	
16.	Problems on Trigonometric Fourier Series (TFS), Exponential Fourier Series (EFS)	1	25-07-2025		TLM1	
17.	Relationship between TFS and EFS	1	28-07-2025		TLM1	
18.	**Activity:** Group Discussion on Fourier series	1	29-07-2025		TLM4	

19.	**Fourier Transform:** Existence of Fourier Transform	1	30-07-2025		TLM1	
20.	Properties of Fourier Transform	2	01-08-2025 04-08-2025		TLM1	
21.	Problems on Fourier Transform	1	05-08-2025		TLM1	
22.	**Sampling Theorem:** Sampling Theorem for band limited signals	1	06-08-2025		TLM1	
23.	Reconstruction of original signal from sampled signal	1	08-08-2025		TLM1	
24.	Types of Samplings, Effects of Under Sampling-Aliasing	1	11-08-2025		TLM1	
25.	Problems on sampling Theorem	1	12-08-2025		TLM1	
26.	Revision	1	13-08-2025		TLM1	
No. of classes required to complete UNIT-II: 15				**No. of classes taken:**		

UNIT-III: Signal Transmission through linear systems, Z-Transform

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	**Signal Transmission through linear systems:** Definition of system	1	18-08-2025		TLM1	
28.	Linear and Nonlinear systems	1	19-08-2025		TLM1	
29.	Time invariant and Time variant systems	1	20-08-2025		TLM1	
30.	Causal and Non causal systems, stable and unstable systems	1	22-08-2025		TLM1	
31.	Problems on types of systems	1	06-10-2025		TLM1	
32.	Response of Linear systems-convolution in Continuous time domain	2	07-10-2025 08-10-2025		TLM1	
33.	Response of Linear systems-convolution in Discrete time domain	1	10-10-2025		TLM1	
34.	**Z-Transform**: Z-Transform Definition, Region of convergence Definition	1	13-10-2025		TLM1	
35.	ROC Properties	1	14-10-2025		TLM1	
36.	Properties of Z-Transform	1	15-10-2025		TLM1	
37.	Inverse Z-Transform through Partial fractions	1	17-10-2025		TLM1	

38.	**Activity:** Quiz on Systems and Z-Transform	1	21-10-2025		TLM4	
No. of classes required to complete UNIT-III: 13				**No. of classes taken:**		

UNIT-IV: Discrete Fourier Transform, Fast Fourier Transform

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
39.	**Discrete Fourier Transform(DFT)**:Introduction to DFT, Concept of DFT	1	22-10-2025		TLM1	
40.	Properties of DFT	1	24-10-2025		TLM1	
41.	Circular convolution, Problems	1	27-10-2025		TLM1	
42.	Problems on DFT	1	28-10-2025		TLM1	
43.	**Fast Fourier Transform:** Need of FFT	1	29-10-2025		TLM1	
44.	Radix-2 Decimation in Time FFT Algorithm	1	31-10-2025		TLM1	
45.	Radix-2 Decimation in Frequency FFT Algorithm	1	03-11-2025		TLM1	
46.	Inverse FFT	1	04-11-2025		TLM1	
47.	**Activity:** Computation of N-point DFT ,IDFT using MATLAB	1	05-11-2025		TLM4	
No. of classes required to complete UNIT-IV: 09				**No. of classes taken:**		

UNIT-V: Filters, IIR Filter Design, FIR Filter Design

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
48.	**Filters**: Concept of Filter, Characteristics of Filters-LPF, HPF,BPF,BSF	1	07-11-2025		TLM1	
49.	**IIR Filter Design:** Specifications of IIR Filters	1	10-11-2025		TLM1	
50.	Analog Butterworth IIR filter design using Impulse Invariant Transformation, Bilinear Transformation	1	11-11-2025		TLM1	
51.	Problems on IIR filter design	1	12-11-2025		TLM1	
52.	**FIR Filter Design:** Design of FIR filters using FS Method	1	14-11-2025		TLM1	
53.	Rectangular window, Hanning window, Hamming window	1	17-11-2025		TLM1	
54.	Problems on FIR Filter design	1	18-11-2025		TLM1	
55.	**Activity:** Design of Filters using MATLAB	1	19-11-2025		TLM4	
No. of classes required to complete UNIT-V: 8				**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
56.	Applications of signal Processing	1	20-11-2025		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 (R20 Regulation):

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

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education
PEO 2	To Function professionally in the rapidly changing world with advances in technology
PEO 3	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices
PEO 4	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner?

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 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	Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry
PSO 2	Design and Analyze Analog and Digital Electronic Circuits or systems and implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Date: 30-06-2025

Title	**Course Instructor**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr.P. Venkateswara Rao**	**Dr. GLN Murthy**	**Dr. G.Srinivasulu**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier - I), ISO 21001:2018 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: Mr.MB.Chakravarthy, Sr. Asst.Professor
Course Name & Code : Linear Control Systems-20EE81 **Regulation**: R20
L-T-P Structure : 3-0-0 **Credits:** 03
Program/Sem/Sec : B. Tech. VII-Sem., Aerospace Engineering **A.Y.:** 2025-26

PRE-REQUISITE: None

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to introduce to the students the principles and applications of control systems in everyday life. It deals with the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems the different aspects of stability analysis of systems in frequency domain and time domain.

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

CO1	Develop mathematical model of linear time invariant systems. **(Apply-L3)**
CO2	Realize transfer function representation of system from conventional and state space approach **(Apply-L3)**
CO3	Analyze linear time invariant systems in Time domain **(Apply-L3)**
CO4	Analyze time invariant systems in Frequency domain**(Apply-L3)**

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

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

TEXTBOOKS:

T1	B. C. Kuo , "Automatic Control Systems" , John wiley and sons ,9th edition, 2014
T2	I. J. Nagrath and M. Gopal, "Control Systems Engineering", New Age International (P) Limited, 6th edition , 2017

REFERENCE BOOKS:

R1	Katsuhiko Ogata , "Modern Control Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition,1998.
R2	Norman S. Nise, "Control Systems Engineering" , John Wiley, New Delhi,6thedition, 20122012

PART-B

COURSE DELIVERY PLAN (LESSON PLAN)

UNIT-I: MATHEMATICAL MODELLING OF CONTROL SYSTEM

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to course, Course Outcomes, Introduction to UNIT-I	1	30-06-25			
2	Concepts of Control SystemsClassification of control systems, Open Loop and closed loop control systems - Different examples of control systems.	1	01-07-25			
3	Mathematical models – Differential equations, Impulse Response and transfer functions	1	03-07-25			
4	Translational and Rotational mechanical systems	1	04-07-25			
5	Block diagram representation of systems -	1	07-07-25			
6	Block diagram algebra,	1	08-07-25			
7	Signal flow graph - Reduction using Mason's gain formula.	1	10-07-25			
8	Problem solving	1	11-07-25			
9	Problem solving	1	14-7-25			
10	Problem solving	1	15-07-25			
11	Problem solving	1	17-07-25			
12	Problem solving	1	18-07-25			
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: **TIME RESPONSE ANALYSIS-I**

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13	Standard test signals	1	21-07-25			
14	Time response of first order systems	1	22-07-25			
15	Time response of second order systems	1	24-07-25			
16	Time domain specifications	1	25-07-25			
17	Problems solving on Second order systems	1	28-07-25			
18	Problems solving on Second order systems	1	29-07-25			
19	Problems solving on Second order systems	1	31-07-25			
20	Problems solving on Second order systems	1	01-08-25			
21	Problems solving on Second order systems	1	04-08-25			
22	Steady state errors and error constants	1	05-08-25			
23	Steady state errors and error constants	1	07-08-25			
24	Steady state errors and error constants	1	08-08-25			
No. of classes required to complete UNIT-II: 12				**No. of classes taken:**		

UNIT-III: TIME RESPONSE ANALYSIS-II

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25	The concept of stability	1	11-08-25			
26	R-H stability criterion,	1	14-08-25			
27	The root locus concept - construction of root loci	1	18-08-25			
28	Relative stability analysis	1	06-10-25			
29	Problems on construction of Root locus	1	07-10-25			
30	Problems on construction of Root locus& Relative stability	1	09-10-25			
31	Problems on construction of Root locus& Relative stability	1	10-10-25			
32	Problems on construction of Root locus& Relative stability	1	13-10-25			
33	Problems on construction of Root locus& Relative stability	1	14-10-25			

34	Problems on construction of Root locus& Relative stability	1	16-10-25			
35	Problems on construction of Root locus& Relative stability	1	17-10-25			
No. of classes required to complete UNIT-III: 11				**No. of classes taken:**		

UNIT-IV: **FREQUENCY RESPONSE 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
36	IntroductionFrequencydomain specifications	1	20-10-25			
37	Frequency domain specifications	1	23-10-25			
38	Polar Plot	1	24-10-25			
39	Bode diagrams	1	27-10-25			
40	Stability Analysis from Bode Plots	1	28-10-25			
41	Nyquiat stability criterion	1	30-10-25			
42	Nyquist Plot	1	31-10-25			
43	Phase margin and Gain margin	1	3-11-25			
44	Problems on Bode Plots	1	4-11-25			
45	Problems on Bode Plots	1	6-11-25			
46	Problems on Polar Plot	1	7-11.25			
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: **: : STATE SPACE ANALYSIS OF CONTINUOUS 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
47	Concepts of state, state variables and state model, Problems on state model	1	10.11.25			
48	Canonical state space models	1	13.11.25			
49	solving the Time invariant state Equations- State Transition Matrix and it's Properties	1	14.11.25			
50	Concepts of Controllability and Observability	1	17.11.25			
51	Problems on Canonical state space models	1	18.11.25			
52	Problems on state equation	1	20.11.25			
No. of classes required to complete UNIT-V: 6				**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
56	Applications of control systems	2	19-8-25 20-11-25		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 (R20 Regulation):

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

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education
PEO 2	To Function professionally in the rapidly changing world with advances in technology
PEO 3	To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices
PEO 4	To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner?

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power.
PSO 2	Design and analyze electrical machines, modern drive and lighting systems.
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems.
PSO 4	Design controllers for electrical and electronic systems to improve their performance.

Date: 03-07-2023

Title	Course Instructor	Module Coordinator	Head of the Department
Name of the Faculty	**Mr.MB Chakravarthy**	**Dr.G.Nageswar Rao**	**Dr. P.Sobha Rani**
Signature			

Program Specific Outcomes (PSOs):

PSO1: PSO2:

PSO3: PSO4:

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

PART - A

PROGRAM : B.Tech. - VII-Sem. - ASE – A Section
ACADEMIC YEAR : 2025-26
COURSE NAME & CODE : Management Science for Engineers – 20HS02
L-T-P STRUCTURE : 4-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : Mr. B. Udaya Lakshmi, Assistant Professor
COURSE COORDINATOR : Dr. A. Nageswara Rao, Sr. Assistant Professor
PER-REQUISITE : NIL

COURSE EDUCATIONAL OBJECTIVES:

1. To make students understand management, its principles, contribution to management, organization, and its basic issues and types.
2. To make students understand the concept of plant location and its factors and plant layout and types, method of production and work study importance.
3. To understand the purpose and function of statistical quality control. And understand the material management techniques.

COURSE OUTCOMES:

After completion of the course student will be able to:
CO1: Understand management principles to practical situations based on the organization structures. **(L2)**
CO2: Design Effective Plant Layouts by using work study methods. **(L2)**
CO3: Apply quality control techniques for improvement of quality and materials management. **(L3)**
CO4: Develop best practices of HRM in corporate Business to raise employee productivity. **(L2)**
CO5: Identify critical path and project completion time by using CPM and PERT techniques. **(L3)**

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	3	3	2	3				3			3		3
CO2	3	3	1	2	1				3			3		3
CO3	3	3	3	2	1				3			3		3
CO4	3	2	3	2	3				1			3		3
CO5	2	3	3	2	1				1			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:

1. Dr. A.R.Aryasri, Management Science, TMH, 10th edition, 2012

References:

1. Koontz & weihrich – Essentials of management, TMH, 10th edition, 2015
2. Stoner, Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004
3. O.P. Khana, Industrial engineering and Management L.S.Srinath, PERT & CPM

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION

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 Management	1	30-06-2025		TLM1	CO1	T1	
2.	Definition, Nature, Importance of management	1	1-07-2025		TLM1	CO1	T1	
3.	Functions of Management	1	2-07-2025		TLM1	CO1	T1	
4.	Taylor's scientific management theory	1	3-07-2025		TLM1	CO1	T1	
5.	Fayal's principles of management	1	7-07-2025		TLM3	CO1	T1	
6.	Contribution of Elton mayo, Maslow	1	8-07-2025		TLM1	CO1	T1	
7.	Herzberg, Douglas MC Gregor principles of management	1	9-07-2025		TLM1	CO1	T1	
8.	Basic Concepts of Organization, Authority, Responsibility	1	10-07-2025		TLM1	CO1	T1	
9.	Delegation of Authority, Span of control	1	14-07-2025		TLM1	CO1	T1, R1	
10.	Departmentation and Decentralization	1	15-07-2025		TLM1	CO1	T1, R1	
11.	Organization structures (Line organization)	1	16-07-2025		TLM1	CO1	T1, R1	
12.	Line and Functional staff organization,	1	17-07-2025		TLM1	CO1	T1	
13.	Committee and Matrix organization	1	21-07-2025		TLM3	CO1	T1	
No. of classes required to complete UNIT-I		**13**			**No. of classes taken:**			

UNIT-II: OPERATIONS MANAGEMENT

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
14.	Introduction, Plant location	1	22-07-2025		TLM1	CO2	T1, R3	
15.	Factors influencing location	1	23-07-2025		TLM1	CO2	T1, R3	
16.	Principles of plant layouts	1	24-07-2025		TLM1	CO2	T1, R3	
17.	Types of plant layouts	1	28-07-2025		TLM1	CO2	T1, R3	
18.	Methods of production	1			TLM1	CO2	T1, R3	

19.	Work study	1	29-07-2025		TLM3	CO2	T1, R3	
20.	Work study methods	1	30-7-2025		TLM1	CO2	T1	
21.		1	31-7-2025		TLM1	CO2	T1	
22.	Basic procedure involved in method study	1	4-08-2025		TLM1	CO2	T1	
23.	Work measurement	1	5-08-2025		TLM3	CO2	T1	
24.	Work measurement	1	6-08-2025		TLM1	CO2	T1	
25.		1	7-08-2025		TLM1	CO2	T1	
No. of classes required to complete UNIT-II		**12**	11-8-2025		**No. of classes taken:**			

UNIT-III: STATISTICAL QUALITY CONTROL & MATERIALS MANAGEMENT

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
26.	Introduction, Concept of Quality, Quality Control functions	1	12-8-2025		TLM1	CO3	T1	
27.	Meaning of SQC, Variables and attributes	1	13-8-2025		TLM1	CO3	T1, R1	
28.	X chart, R Chart	1	14-8-2025		TLM1	CO3	T1, R1	
29.	C Chart, P Chart	1	18-8-2025		TLM1	CO3	T1	
30.	Simple problems	1	19-8-2025		TLM3	CO3	T1, R1	
31.	Acceptance sampling, Sampling plans	1	20-8-2025		TLM1	CO3	T1, R1	
CRT Classes 25.08.2025 to 20.09.2025								
32.	Deming's contribution to quality	1	22-9-2025		TLM1	CO3	T1	
33.	Materials management Meaning and objectives	1	23-9-2025		TLM1	CO3	T1, R1	
34.	Inventory control & Need for inventory control	1	24-9-2025		TLM1	CO3	T1, R1	
35.	Purchase procedure, Store records	1	25-9-2025		TLM1	CO3	T1	
36.	EOQ, ABC analysis	1	29-9-2025		TLM3	CO3	T1	
37.	Stock levels	1	1-10-2025		TLM1	CO3	T2	
No. of classes required to complete UNIT-III		**12**						

UNIT-IV: HUMAN RESOURCE MANAGEMENT (HRM)

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
38.	Introduction	1	6-10-2025		TLM1	CO4	T1	

39.	Concepts of HRM	1	7-10-2025		TLM1	CO4	T1	
40.	Basic functions of HR manager	1	8-10-2025		TLM1	CO4	T1, R2	
41.	Man power planning	1	9-10-2025		TLM3	CO4	T1, R2	
42.	Recruitment	1	13-10-2025		TLM1	CO4	T1, R2	
43.	Selection,	1	14-10-2025		TLM1	CO4	T1, R1	
44.	Training & developmemt	1	15-10-2025		TLM1	CO4	T1, R1	
45.	Placement	1	16-10-2025		TLM1	CO4	T1	
46.	Wage and salary administration	1	20-10-2025		TLM3	CO4	T1, R1	
47.	Promotion, Transfers Separation	1	23-10-2025		TLM1	CO4	T1, R1	
48.	Performance appraisal	1	27-10-2025		TLM1	CO4	T1	
49.	Job evaluation and merit rating	1	28-10-2025		TLM3	CO4	T1	
No. of classes required to complete UNIT-IV		**12**			**No. of classes taken:**			

UNIT-V: PROJECT MANAGEMENT

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
50.	Introduction	1	29-10-2025		TLM1	CO5	T1,R2	
51.	Early techniques in project management	1	30-10-2025		TLM1	CO5	T1, R2	
52.	Network analysis	1	3-11-2025		TLM1	CO5	T1,R2	
53.	Programme Evaluation and Review Technique (PERT)	1	4-11-2025		TLM1	CO5	T1,R2	
54.	Problems	1	5-11-2025		TLM1	CO5	T1,R2	
55.	Critical path method (CPM)	1	6-11-2025		TLM1	CO5	T1, R2	
56.	Identifying critical path	1	10-11-2025		TLM1	CO5	T1,R2	
57.	Problems	1	11-11-2025		TLM1	CO5	T1,R2	
58.	Probability of completing project within given time	1	12-11-2025		TLM1	CO5	T1,R2	
59.	Project cost analysis	1	13-11-2025		TLM1	CO5	T1, R2	
60.	Problems	1	18-11-2025		TLM1	CO5	T1,R2	
61.	project crashing	1	19-11-2025		TLM1	CO5	T1,R2	
62.	Simple problems	1	20-11-2025		TLM1	CO5	T1,R2	
No. of classes required to complete UNIT-V		**13**			**No. of classes taken:**			

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

Part – C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment 1	1	A1=5
Assignment 2	2	A2=5
I-Mid Examination	1,2,3	B1=15
Quiz – 1	1,2,3	Q1=10
Assignment 3	3	A3=5
Assignment 4	4	A4=5
Assignment 5	5	A5=5
II-Mid Examination	3,4,5	B2=15
Quiz – 2	3,4,5	Q2=10
Evaluation of Assignment: 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=15
Evaluation of Quiz Marks: Q=75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	1,2,3,4,5	Q=10
Cumulative Internal Examination: A+B+Q	**1,2,3,4,5**	**CIE=30**
Semester End Examinations	**1,2,3,4,5**	**SEE=70**
Total Marks: CIE+SEE	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Pursue higher education, entrepreneurship and research to compete at global level.

PEO2: Design and develop products innovatively in the area of computer science and engineering and in Other allied fields.

PEO3: Function effectively as individuals and as members of a team in the conduct of interdisciplinary Projects and even at all the levels with ethics and necessary attitude.

PEO4: Serve ever-changing needs of the society with a pragmatic perception.

PROGRAMME 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 Investigations of Complex Problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5 - Modern Tool Usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO6 - The Engineer and Society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7 - Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8 - Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9 - Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10 - Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11 - Project Management and Finance: Demonstrate knowledge and understanding of the ring and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12 - Life-long Learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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

Course Instructor	Course Coordinator	Module Coordinator	HoD

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

COURSE HANDOUT

PROGRAM	:	B.Tech, VII Sem, Aerospace Engineering
ACADEMIC YEAR	:	2025-2026
COURSE NAME AND CODE	:	20AES3-FLUID FLOW ANALYSIS USING ANSYS FLUENT
L-T-P STRUCUTRE	:	1-0-2
COURSE CREDITS	:	2
COURSE INSTRUCTOR	:	Dr. A Revanth Reddy/ Dr. Sreenadh Chevula
COURSE COORDINAOTR	:	Dr. A Revanth Reddy

PRE-REQISITE

Course educational objectives : To learn the finite element package ANSYS Fluent to analyze the incompressible and compressible flow field characteristics

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

CO 1	To demonstrate the various modules of Ansys Fluent [Apply-L3]
CO 2	To solve and analyze the characteristics of flow over aerodynamic objects and flow through ducts [Analyze-L4]

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	**PSO 1**	**PSO 2**
CO 1	**3**	**2**	**2**	**-**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**
CO 2	**3**	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**3**	**-**	**-**	**3**	**3**	**3**

BOOKS APPROVED TEXT BOOKS

T 1 ANSYS Fluent Tutorial Guide 18.1 BY ANSYS, Inc. Release 18.0, Southpointe January 2017 ,2600 ANSYS Drive, Canonsburg, PA 15317

COURSE DELIVERY PLAN (LESSON PLAN)

Module - I Introduction

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text book	HoD Sign
1	Introduction to ANSYS Fluent,		30-06-2025		2	CO1	T1	
2	Basic Steps for CFD Analysis using ANSYS Fluent,	18	30-06-2025		2	CO1	T1	
3	Guide to a Successful Simulation Using ANSYS Fluent,		07-07-2025		2	CO1	T1	
4	Starting and Executing ANSYS Fluent		14-07-2025		2	CO1	T1	
5	Introduction, Viewing, 2D Sketching,		21-07-2025		2	CO1	T1	
6	Selection, Planes and Sketches, Geometry		28-07-2025		2	CO1	T1	
7	Representations, 3D Modelling		04-08-2025		2	CO1	T1	
Total No of classes required to complete Module I		18	No of Classes Taken:					

Module II (Meshing)

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text Book	HoD Sign
1	Introduction to Meshing Mode in Fluent,	9	11-08-2025		2	CO1	T1	
2	Starting Fluent in Meshing Mode, Graphical User Interface,		18-08-2025		2	CO1	T1	
3	Size Functions and Scoped Sizing,		25-08-2025		2	CO1	T1	

08-09-2025 to 13-09-2025 MID-1 Examination

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text Book	HoD Sign
4	Mesh, Determining Mesh Statistics and Quality	6	06-10-2025		2	CO1	T1	
5	Object Based Meshing - Surface, Volume, Creating		13-10-2025		2	CO1	T1	
Total No of classes required to complete Module II		15	No of Classes Taken :					

Module III (Solver Settings and Solution)

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text Book	HoD Sign
1	Introduction, Solution Procedure Overview	09	20-10-2025		2	CO1	T1	
2	Available Solvers, Choosing a Solver, Discretisation, Initialization,		25-10-2025		2	CO1	T1	

3	Case Check, Convergence, Solution Accuracy,		27-10-2025		2	CO1	T1	
4	Grid-Independent Solutions, Mesh Adaption,		01-11-2025		2	CO1	T1	
	Total No of classes required to complete Module III	09	No of Classes Taken :	12				

Module IV (post-processing)

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text book	HoD Sign
1	Overview, GUI Layout, Case Comparison,	06	03-11-2025		2	CO1	T1	
2	Creating Locations-types, Colour, Render and View,		08-11-2025		2	CO1	T1	
3	Files Other Graphics Objects, Generating Tables,		10-11-2025		2	CO1	T1	
4	Charts and Reports, Animation,		15-11-2025		2			
	Total No of classes required to complete Module IV	06	No of Classes Taken:					

Module V (Tutorials)

S. No	Topics to be Covered	No of classes required	Tentative date of completion	Actual Date of completion	TLM method	Learning Outcomes	Text Book	HoD Sign
1	Fluid Flow and Heat Transfer in a Mixing Elbow,	06	17-11-2025		2	**CO2**	T1	
2	Flow over Cylinder, Compressible Flow over Airfoil,		17-11-2025		2	**CO2**	T1	
3	Flow through convergent nozzle, Flow through convergent-divergent Nozzle,		22-11-2025		2	**CO2**	T1	
	Total No of classes required to complete Module V	06	No of Clasess Taken :					

24-11-2025 to 29-11-2025 MID-2 Examination

29-11-2025 to 15-12-2025 Semester end examination.

Teaching Learning Method	
TLM2	PPT and Chalk, Talk and System demo