LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: K. N. V. Lakshmi
Course Name & Code **:** Numerical Methods & Integral Calculus & 20FE10
L-T-P Structure **:** 2-1 -0 **Credits:3**
Program/Sem/Sec : II B.Tech/III sem/ASE **A.Y.:** 2021 - 22

PREREQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to enable the students learn Numerical Techniques for solving the equations and apply interpolation techniques. They will also learn about the Fourier analysis of single valued functions, Multiple Integrals in different coordinate systems and Vector differentiation.

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

CO1	Estimate the best fit polynomial for the given tabulated data using Interpolation.(Understand – L2)
CO2	Apply numerical techniques in solving of equations and evaluation of integrals. (Apply – L3)
CO3	Discriminate among Cartesian, Polar and Spherical coordinates in multiple integrals and their respective applications to areas and volumes. (Apply – L3)
CO4	Generate the single valued functions in the form of Fourier series and obtain Fourier series representation of periodic function. (Apply – L3)
CO5	Evaluate the directional derivative, divergence and angular velocity of a vector function. (Apply – L3)

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

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

TEXTBOOKS:

T1 Dr. B.S. Grewal, "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, New Delhi, 2012.

T2 Dr. B. V. Ramana, "Higher Engineering Mathematics", 1st Edition, TMH, New Delhi, 2010.

T3 S. S. Sastry, *"Introductory Methods of Numerical Analysis"* 5th Edition, PHI Learning Private Limited, New Delhi, 2012.

REFERENCE BOOKS:

R1 M. D. Greenberg, "Advanced Engineering Mathematics", 2nd Edition, TMH Publications, New Delhi, 2011.

R2 Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, John Wiley & sons, New

Delhi, 2011.

R3 W.E. Boyce and R. C. Diprima, " Elementary Differential Equations" , 7th Edition, John Wiley & sons, New Delhi,2011.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Interpolation and Finite Differences

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 the course, Course Outcomes	1	25/10/21		TLM1	
2.	Introduction to UNIT I	1	27/10/21		TLM2	
3.	Forward Differences	1	28/10/21		TLM1	
4.	Backward differences	1	30/10/21		TLM1	
5.	Central Differences	1	01/11/21		TLM1	
6.	Symbolic relations and separation of symbols	1	03/11/21		TLM1	
7.	Newton's forward formulae for interpolation	1	06/11/21		TLM1	
8.	Newton's backward formulae for interpolation	1	08/11/21		TLM1	
9.	Lagrange's Interpolation	1	10/11/21		TLM1	
10.	TUTORIAL I	1	11/11/21		TLM1	
11.	Lagrange's Interpolation	1	13/11/21		TLM3	
No. of classes required to complete UNIT-I: 11				**No. of classes taken:**		

UNIT-II: Numerical solutions of Equations and Numerical Integration

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
12.	Introduction to UNIT II	1	15/11/21		TLM2	
13.	Algebraic and Transcendental Equations	1	17/11/21		TLM1	
14.	False Position method	1	18/11/21		TLM1	
15.	False Position method	1	20/11/21		TLM1	
16.	Newton- Raphson Method in one variable	1	22/11/21		TLM1	
17.	Newton- Raphson Method applications	1	24/11/21		TLM1	
18.	Tutorial II	1	25/11/21		TLM3	
19.	Trapezoidal rule	1	27/11/21		TLM1	
20.	Simpson's 1/3 Rule, Simpson's 3/8 Rule	1	29/11/21		TLM1	
No. of classes required to complete UNIT-II: 9				**No. of classes taken:**		

UNIT-III: Multiple Integrals

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Introduction to Unit-III	1	01/12/21		TLM2	
22.	Double Integrals -Cartesian coordinates	1	02/12/21		TLM1	
23.	Double Integrals- Polar co ordinates, Spherical Co ordinates	1	04/12/21		TLM1	
24.	Triple Integrals - Cartesian coordinates	1	06/12/21		TLM1	

25.	TUTORIAL - III	1	08/12/21		TLM1	
26.	Triple Integrals – Polar,Spherical coordinates	1	09/12/21		TLM3	
27.	Applications to Double integrals (Content Beyond the syllabus)	1	11/12/21		TLM 1	
28.	Change of order of Integration	1	20/12/21		TLM1	
29.	Change of order of Integration	1	22/12/21		TLM1	
No. of classes required to complete UNIT-III: 9				**No. of classes taken:**		

UNIT-IV: Fourier Series

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Introduction to UNIT IV	1	23/12/21		TLM1	
31.	Determination of Fourier coefficients, Even and Odd Functions	1	27/12/21		TLM1	
32.	Fourier Series in the [0,2pi]	1	29/12/21		TLM1	
33.	Fourier Series in the [0,2pi]	1	30/12/21		TLM1	
34.	Fourier Series in an arbitrary interval	1	03/01/22		TLM1	
35.	TUTORIAL IV	1	05/01/22		TLM3	
36.	Fourier Series in an arbitrary interval	1	06/01/22		TLM1	
37.	Fourier series in an arbitrary interval odd and even functions		08/01/22		TLM1	
38.	Half-range Sine and Cosine series	1	10/01/22		TLM1	
39.	Half-range Sine and Cosine series	1	12/01/22		TLM1	
No. of classes required to complete UNIT-IV: 10				**No. of classes taken:**		

UNIT-V: Vector Differentiation

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Introduction to UNIT V	1	17/01/22		TLM1	
41.	Vector Differentiation	1	19/01/22		TLM1	
42.	Gradient	1	20/01/22		TLM1	
43.	Directional Derivative	1	22/01/22		TLM1	
44.	Divergence	1	24/01/22		TLM1	
45.	TUTORIAL - VII	1	27/01/22		TLM3	
46.	Curl	1	29/01/22		TLM1	
47.	Solenoidal fields, Irrotational fields, potential surfaces	1	31/01/22		TLM1	
48.	Laplacian, second order operators	1	02/02/22		TLM1	
49.	TUTORIAL - VIII	1	03/02/22		TLM 1	
50.	Properties	1	05/02/22		TLM1	
No. of classes required to complete UNIT-V: 11				**No. of classes taken:**		

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

PART-C

EVALUATION PROCESS (R17 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. N. V. Lakshmi**	**Dr. K. R. Kavitha**	**Dr. A. Rami Reddy**	**Dr. A. Rami Reddy**
Signature				

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COURSE HANDOUT
PART-A

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

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : **Engineering Fluid Mechanics**-**20AE02**

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

COURSE CREDITS : 3

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

PRE-REQUISITE: Nil

Course Educational Objectives: To demonstrate the properties of fluids and behavior of fluids under static conditions, differential relations for fluid flows, features of flow though pipes and to understand the working of Hydraulic turbines and Hydraulic pumps.

Course Outcomes: At the end of the course, the student will be able to
CO1: Analyze the forces acting on objects submerged in fluids under static conditions (Analyze-L4)
CO2: Apply differential relations to characterize the behavior of fluid flow (Apply-L3)
CO3: Apply the conservation laws to solve elementary fluid flow problems (Apply-L3)
CO4: Analyze the simple pipe network for fluid transportation (Apply-L3)
CO5: Analyze the performance of various hydraulic turbines and pumps (Analyze-L4)

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

Course Code	Cos	Program Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
17AE01	CO1	3	1											2	2
	CO2	3	3	3										3	3
	CO3	3	3											3	3
	CO4	3	3	3										1	1
	CO5	3	2	1										1	1
1 = Slight (Low)		**2 = Moderate (Medium)**									**3-Substantial(High)**				

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

TEXT BOOKS:

T1 White. F.M, Fluid Mechanics, Seventh Edition, McGraw-Hill Education 2011.

T2 Rathakrishnan. E, Fluid Mechanics an Introduction, Fourth Edition, Prentice Hall of India, 2022

REFERENCE BOOKS:

R1 Balachandran P, Engineering Fluid Mechanics, Prentice Hall of India, 2012

R2 Fox. R.W, Mcdonald, A.J, Introduction of Fluid Mechanics, Fifth Edition, John Wiely, 1999

R3 Douglas. J.F, Gesiorek. J.M., Swaffield. J, A., Fluid Mechanics, Fourth Edition, Pearson Education, 2002.

R4 Shames. I.H, Mechanics of Fluids, Third Edition, McGraw-Hill, 1992

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction and Fluid Statics

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 and Overview of the course, Dissemination of course outcomes, General description of Fluid Mechanics, Applications of Fluid Mechanics, Classification of Fluids, Fluids and Continuum	1	25-10-2021		TLM1	
2.	Properties of Fluid –Pressure, Temperature, Density, Specific Weight, Specific Gravity, Viscosity-Newton's Law of Viscosity	2	26-10-2021 29-10-2021		TLM1	
3.	Compressibility, Surface Tension, Capillarity, Vapor Pressure	1	30-10-2021		TLM1	
4.	Fluid Statics: Pressure Acting at a Point in a Static Fluid-Pascal's Law	1	1-11-2021		TLM1	
5.	Basic Equation of Fluid Statics,	1	2-11-2021		TLM1	

	Hydrostatic Pressure Distributions					
6.	Manometers	2	5-11-2021, 6-11-2021		TLM1	
7.	Hydrostatic Pressure Distributions in gases (earth's atmosphere)	1	8-11-2021		TLM1	
8.	Hydrostastic forces on submerged plane surface (derivation)	1	9-11-2021		TLM1	
9.	Buoyancy and Stability	1	12-11-2021		TLM1	
10.	Tutorial	1	13-11-2021		TLM3	
11.	Assignment/Quiz-1	1	15-11-2021		---	
No. of classes required to complete UNIT-I		**13**		**No. of classes taken:**		

UNIT-II: Analysis of Fluid Flow and Differential Relations for Fluid Flow

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
	Lagrangian and Eulerian approaches, Flow Patterns-Pathline, Streamline, Streakline, Timeline, Stream Tube	1	16-11-2021		TLM1, TLM2	
12.	Differential Relations of Fluid Flow: Velocity Field, Acceleration Field of a Fluid	1	19-11-2021		TLM1,TLM2	
13.	Differential Equation of Mass Conservation	1	20-11-2021		TLM1,TLM2	
14.	Stream Function, Velocity Potential Vorticity, Rotationality, Irrotationality	2	22-11-021, 23-11-2021		TLM1	
15.	Differential Equation of Linear Momentum, Euler's Equations	2	26-11-2021, 27-11-2021		TLM1, TLM2	

16.	Potential Flow, Bernoulli's Equation	2	29-11-2021, 30-11-2021		TLM1	
17.	Bernoulli's Equation and its Applications, Orifice, Venturi meter	1	3-12-2021		TLM1	
18.	Tutorial	1	4-12-2021		TLM3	
19.	Assignment/Quiz-2				----	
No. of classes required to complete UNIT-II		**11**		**No. of classes taken:**		

I Mid Examination (13/12/2021 to 18/12/2021)

UNIT-III: Flow through Pipes, Dimensional Analysis & Similarity

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20.	Flow Through Pipes: Reynolds Experiment, Reynolds number	1	6-12-2021		TLM1,TLM4	
21.	Head loss, Darcy-Wiesbach equation, Hydraulic Gradient &Total Energy Lines	1	7-12-2021		TLM1, TLM2	
22.	Laminar Fully Developed Pipe Flow- Hagen Poiseuille Law	1	10-12-2021		TLM1	
23.	Pipes in Series, Pipes in Parallel,	1	11-12-2021		TLM1, TLM2	
24.	Equivalent Pipe, Hydraulic Diameter, Minor Losses, Moody Chart and its usage	1	20-12-2021		TLM1	
25.	Introduction, Principle of Dimensional Homogeneity,	1	21-12-2021		TLM1	
26.	Buckingham's Pi Theorem	1	24-12-2021		TLM1	
27.	Dimensionless Groups, Similarity	1	27-12-2021		TLM1	
28.	Tutorial	1	28-12-2021		TLM3	
29.	Assignment/Quiz-3					
No. of classes required to complete UNIT-III		9		**No. of classes taken:**		

UNIT-IV: Hydraulic Turbines & Performance of Hydraulic Turbines

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Introduction, Classification of turbines- Hydro-electric power plants impulse and reaction turbines,	2	31-12-2021 3-1-2022		TLM1	
31.	Pelton Turbine working principle	1	4-1-2022		TLM1,TLM5	
32.	Velocity triangles, Work done, Efficiency, Condition for maximum efficiency	1	7-1-2022		TLM1	
33.	Francis Turbine, working principle	1	8-1-2022		TLM1	
34.	Velocity triangles, Work done and Efficiency	2	10-1-2022 11-1-2022		TLM1	
35.	Kaplan Turbine, working principle, Velocity triangles, Work done and Efficiency	1	17-1-2022		TLM1	
36.	Draft Tube and its theory	1	18-1-2022		TLM1	
37.	Geometric similarity, Unit and specific quantities	1	21-1-2022		TLM1	
38.	Tutorial	1	22-1-2022		TLM3	
39.	Assignment/Quiz-4					
No. of classes required to complete UNIT-IV		11		**No. of classes taken:**		

UNIT-V: Reciprocating and Centrifugal Pumps

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Reciprocating Pumps: Classification, Working Principle,	1	24-1-2022		TLM1,TLM5	

41.	Co-efficient of Discharge and Slip, Indicator Diagram	1	25-1-2022		TLM1	
42.	Centrifugal Pumps: Classification, Working Principle, Constructional Details	1	28-1-2022		TLM1,TLM5	
43.	Velocity Triangles, Work done, Head and Efficiencies	1	29-1-2022		TLM1	
44.	Losses, Specific Speed, Pumps in Series and Parallel	1	31-1-2022		TLM1	
45.	Performance Characteristics	1	1-2-2022		TLM1	
46.	Tutorial -5	1	4-2-2022		TLM3	
47.	Assignment/Quiz-5	1	5-2-2022			
48.	Revision				TLM2	
No. of classes required to complete UNIT-V		**8**		**No. of classes taken:**		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (lab or field visit)
TLM2	PPT	**TLM5**	ICT (NPTEL, Swayam Prabha, MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/project

PART-C

EVALUATION PROCESS (R20 Regulation):

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

PART-D

Program 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)

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 the defense and space research programs

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

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr.I.Dakshina Murthy

Course Name & Code : Engineering Thermodynamics (20AE03) **Regulation**: R20
L-T-P Structure : **2-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech/III/-- **A.Y.:** 2021-2022

PREREQUISITE: NIL

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the basic concepts of energy conversions, laws of thermodynamics, concept of entropy, the properties of different gas mixtures and pure substances and basic aspects of ideal thermal cycles.

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

CO1	Describe the thermodynamic properties of various systems (Understand-L2)
CO2	Apply the laws of thermodynamics to analyze various thermal systems (Apply-L3)
CO3	Analyze the entropy change of various processes (Apply-L3)
CO4	Analyze the properties of different gas mixtures and pure substances (Analyze-L4)
CO5	Analyze ideal gas power cycles and refrigeration cycle to estimate various performance parameters (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	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO3	3	3	3	2	-	-	-	-	-	-	-	3	3	3
CO4	3	3	3	3	-	-	-	-	-	-	-	3	3	3
CO5	2	3	3	3	-	-	-	-	-	-	-	3	3	3
1 - Low **2 –**Medium **3 -** High														

TEXTBOOKS:

T1 Rathakrishnan. E, Fundamentals of Engineering Thermodynamics, Second Edition, Prentice Hall of India, 2010

REFERENCE BOOKS:

R1 Nag. P.K, Engineering Thermodynamics- Fifth Edition, McGraw-Hill, 2013.

R2 Cengel. Y.A and Boles, M.A, Thermodynamics: An Engineering Approach, Seventh Edition, McGraw-Hill, 2011.

R3 Sonntag. R. E, Borgnakke. C, Van Wylen. G. J, Fundamentals of Thermodynamics, Fifth Edition John Wiley & sons, publications Inc, 1998.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: BASIC CONCEPTS AND DEFINITIONS

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.	**Basic Concepts and Definitions:** Introduction	1	26/10/2021		TLM 2	
2.	Macroscopic and Microscopic View Point, Continuum, System, Control Volume, Properties of System	1	27/10/2021		TLM 2	
3.	State and Equilibrium, Thermodynamic Equilibrium	1	28/10/2021		TLM 2	
4.	**Tutorial – I**	1	29/10/2021		TLM 3	
5.	Process- Quasi static process-Cycle	1	02/11/2021		TLM 2	
6.	Temperature -Temperature scales, Problems	2	03/11/2021 05/11/2021		TLM 2	
7.	Zeroth law of Thermodynamics, energy-forms of energy, heat, work, Mechanical forms of work	1	09/11/2021		TLM 2	
8.	**Tutorial – II**	1	10/11/2021		TLM 3	
9.	Moving boundary of system, Thermodynamic definition of work, Moving Boundary work	1	11/11/2021		TLM 2	
10.	Work done in various non-flow process, Problems on Pdv Work	1	12/11/2021		TLM 2	
11.	Problems on Pdv Work, Path and point function	2	16/11/2021 17/11/2021		TLM 2	
12.	**Tutorial - III**	1	18/11/2021		TLM 3	
13.	Assignment/Quiz	1	19/11/2021			
No. of classes required to complete UNIT-I: 15				**No. of classes Taken:**		

UNIT-II: FIRST LAW OF THERMODYNAMICS & ITS ANALYSIS OF CONTROL VOLUME

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14.	**First Law of Thermodynamics**: Introduction	1	23/11/2021		TLM 2	
15.	Joule's Experiment	1	24/11/2021		TLM 2	
16.	First Law Analysis of closed system, Different Forms of Stored Energy	1	25/11/2021		TLM 2	
17.	**Tutorial – IV**	1	26/11/2021		TLM 3	
18.	Energy balance, Internal energy, specific heat, Enthalpy, PMM-I	1	30/11/2021		TLM 2	
19.	Conservation of Energy, Flow Work, Problems on First law applied to closed system	1	01/12/2021		TLM 2	
20.	**First law analysis of control volume-** The Steady Flow Process, Steady Flow Energy Equation	1	02/12/2021		TLM 2	

21.	**Tutorial – V**	1	03/12/2021		TLM 3	
22.	Steady flow engineering devices- Nozzle, Turbine, compressor, Heat Exchanger	1	07/12/2021		TLM 2	
23.	Problems on Steady Flow Devices	2	08/12/2021 09/12/2021		TLM 2	
24.	Assignment/Quiz	1	10/12/2021		TLM 1	
No. of classes required to complete UNIT-II: 12				**No. of classes Taken:**		

UNIT-III: SECOND LAW OF THERMODYNAMICS & ENTROPY

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.	**Second law of thermodynamics** :Introduction, Thermal energy reservoirs, heat engines	1	21/12/2021		TLM 2	
26.	Kelvin-Planks, clausius statement of second law of thermodynamics, Refrigerator, heat pumps,	1	22/12/2021		TLM 2	
27.	Equivalence of kelvin-plank and clausius statements, Perpetual motion machines, reversible and irreversible process	1	23/12/2021		TLM 2	
28.	**Tutorial – VI**	1	24/12/2021		TLM 3	
29.	Carnot cycle, Carnot principles, Corollary of Carnot Theorem, Absolute Thermodynamic Temperature Scale	1	28/12/2021		TLM 2	
30.	Problems	1	29/12/2021		TLM 2	
31.	**Entropy**: Introduction, Clausius inequality, property diagrams	1	30/12/2021		TLM 2	
32.	**Tutorial - VII**	1	31/12/2021		TLM 2	
33.	Max well Relation, entropy change for ideal gases, Isentropic relations for ideal gases, Principle of increase of entropy	1	04/01/2022		TLM 2	
No. of classes required to complete UNIT-III: 9			**No. of classes Taken:**			

UNIT-IV: NON REACTIVE GAS MIXTURES & PROPERTIES OF PURE SUBSTANCES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
34.	**Non reactive gas mixtures**- Introduction, Mass fraction, mole fraction, Daltons law of additive pressures, Amagat's law of additive volumes	1	05/01/2022		TLM 2	
35.	Ideal gas mixture, problems on Gas Mixtures	1	06/01/2022		TLM 2	
36.	**Pure substance**: Introduction, phase of pure substance, Phase change processes, property diagrams	2	07/01/2022 11/01/2022		TLM 2	
37.	**Tutorial – VIII**	1	12/01/2022		TLM 3	
38.	P-V-T surface, property tables, h-s Diagram or Mollier Diagram for pure	1	18/01/2021		TLM 2	

	Substance		19/01/2022			
39.	Problems on Pure Substances	1	20/01/2022		TLM 2	
No. of classes required to complete UNIT-IV: 7			**No. of classes Taken:**			

UNIT-V: GAS POWER CYCLES AND REFRIGERATION CYCLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	**Gas power cycles**-Introduction, Analysis of power cycles- Carnot, Otto	1	21/01/2022		TLM 2	
41.	Analysis of Diesel, Dual	1	25/01/2022		TLM 2	
42.	Analysis of Brayton Cycle, Problems on gas power cycles	1	27/01/2022		TLM 2	
43.	**Tutorial – IX**	1	28/01/2022		TLM 3	
44.	**Refrigeration Cycles**: Reversed Carnot cycle, Bell-Coleman cycle,	1	01/02/2022		TLM 2	
45.	Simple vapor compression cycle, Problems	1	02/02/2022		TLM 2	
No. of classes required to complete UNIT-V: 7			**No. of classes Taken:**			

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

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	**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 provide students with a solid foundation in mathematical, scientific and engineering fundamentals required to solve engineering problems.+
PEO 2	To train students with good scientific and engineering breadth so as to analyze, design, and create novel products and solutions for the real life problems
PEO 3	To prepare students to excel in competitive examinations, postgraduate programs, advanced education or to succeed in industry/technical profession
PEO 4	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
PEO 5	To provide student with an academic environment with awareness of excellence, leadership, and the life-long learning needed for a successful professional career

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design / Development of Solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct Investigations of Complex Problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern Tool Usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
PO 6	**The Engineer and Society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and Sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and Team Work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project Management and Finance:** Demonstrate knowledge and understanding of the 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.
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.

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF AEROSPACE ENGINERRING

COURSE HANDOUT

PART-A

Name of Course Instructor: S.Indrasena Reddy
Course Name & Code **:** Strength of Materials & 20AE04
L-T-P Structure **:3-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech/III Sem **A.Y.:** 2021-22

PREREQUISITE: **Engineering Mechanics**

COURSE EDUCATIONAL OBJECTIVES (CEOs):

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

CO1	Analysis of stress-strain behaviour in different types of members under various load conditions. (Apply - L3)
CO2	Evaluate shear force and bending moment of beams under different loading conditions. (Apply-L3)
CO3	Apply the Theory of Simple bending and Torsion (Apply - L3)
CO4	Evaluate shear stress distributions over different cross sections.(Apply-L3)
CO5	Analysis of deflection of statically determinate beams, and stresses due to internal pressure in thin, thick cylindrical shells. (Analyze-L4)

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

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

TEXTBOOKS:

T1 Ramamrutham. S, Narayanan R, Strength of Materials, Dhanpat Rai & Sons, 2017.

REFERENCE BOOKS:

R1 Popov. E. P, Mechanics of Materials, Prentice Hall Inc, 1976

R2 Andrew. P, Singer F.L., Strength of Materials, Harper and Row Publishers, New York, 1987.

R3 Gambhir. M. L, Fundamentals of Solid Mechanics, PHI Learning, 2009. Subramanian. R, Strength of Materials, Second Edition, Oxford University Press, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: SIMPLE STRESSES AND STRAINS

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 strength of material	1	25-10-21			
2.	Properties of material	1	27-10-21			
3.	Types of stresses strains	1	28-10-21			
4.	Stress strain diagrams	1	29-10-21			
5.	stepped bars, Bars of varying c/s	1	01-11-21			
6.	Composite bar problems	1	03-11-21			
7.	Temperature stresses	1	05-11-21			
8.	strain energy due to axial force	1	08-11-21			
9.	Strain energy problems	1	10-11-21			
10.	Change in Volume	1	11-11-21			
11.	stresses due to sudden loads and impact	1	12-11-21			
12.	Relation between elastic Constants	1	15-11-21			
No. of classes required to complete UNIT-I: 12				**No. of classes taken:**		

UNIT-II: SHEAR FORCE AND BENDING MOMENT

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction to SF and BM	1	17-11-21			
14.	Types of beams, Relationship B/W SF and B.M	1	18-11-21			
15.	SFD & BMD for cantilever beam	1	19-11-21			
16.	Cantilever beam problems	1	22-11-21			
17.	UDL on cantilever beam problems	1	24-11-21			
18.	SFD & BMD for S.S.B	1	25-11-21			
19.	Combination of loads for cantilever	1	26-11-21			
20.	Combination of loads for S.S.B	1	29-11-21			
21.	Point of contra flexure	1	01-12-21			
22.	Maximum Bending Moment	1	02-12-21			
23.	SFD and BMD for Overhang beams	1	03-12-21			
No. of classes required to complete UNIT-II: 11				**No. of classes taken:**		

UNIT-III: STRESSES IN BEAMS, TORSION

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	Theory of simple bending	1	06-12-21			
25.	Derivation of Flexural equation	1	08-12-21			
26.	Section modulus of various cross section	1	09-12-21			
27.	Flexural stresses	1	10-12-21			
28.	Normal stresses due to flexure	1	20-12-21			
29.	Theory of pure torsion & Assumptions	1	22-12-21			
30.	Derivation of Torsion equations	1	23-12-21			
31.	Torsion problems	1	24-12-21			
32.	Power transmitted by shaft	1	27-12-21			
33.	Stresses in solid and hollow shafts	1	29-12-21			
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		

UNIT-IV: SHEAR STRESSES, Principal STRESSES

S.	Topics to be covered	No. of	Tentative	Actual	Teaching	HOD

No.		Classes Required	Date of Completion	Date of Completion	Learning Methods	Sign Weekly
34.	Introduction to shear stress	1	30-12-21			
35.	Shear stress distribution across different C/S's	1	31-12-21			
36.	Shear stress distribution across I,T sections	1	03-01-22			
37.	Shear stress distribution problems	1	05-01-22			
38.	Principal Stresses	1	06-01-22			
39.	Member Subjected to Direct Stresses	1	07-01-22			
40.	Normal & Tangential stresses on inclined planes	1	10-01-22			
41.	Failure Theories	1	12-01-22			
No. of classes required to complete UNIT-IV: 8				**No. of classes taken:**		

UNIT-V: DEFLECTION 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
42.	Introduction to deflection of beams		17-01-22			
43.	Differential equation of Elastic line		19-01-22			
44.	Deflection in statically determinate beams		20-01-22			
45.	Deflection of beams		21-01-22			
46.	Macaulay's Method for prismatic members		24-01-22			
47.	Area moment method for stepped beams		27-01-22			
48.	Introduction- Thin, Thick cylindrical shell		28-01-22			
49.	Hoop and longitudinal stresses thin cylinder		31-01-22			
50.	Thin cylindrical shells		02-02-22			
51.	Hoop and longitudinal stresses thick		03-02-22			
52.	Spherical shells changes in dimensions		04-02-22			
No. of classes required to complete UNIT-V: 11				**No. of classes taken:**		

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

PART-C

EVALUATION PROCESS (R17 Regulation):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Course Instructor	Course Coordinator	Module Coordinator	HOD
(S.Indrasena Reddy)	(S.Indrasena Reddy)	(Dr.Prabhu.L)	(Dr.P.Lovaraju)

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

PROGRAM : **R20-**B.Tech., III-Sem., AE
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : Engineering Fluid Mechanics Laboratory – 20AE51
L-T-P STRUCTURE : 0-0-3
COURSE CREDITS : 1.5
COURSE INSTRUCTOR(S) : Mr.I Dakshina Murthy/Ms.M.Bhuvaneshwari

Course Educational Objectives:

Students will learn about the insights of calculating the discharge in various flow measuring devices, performance parameters of hydraulic machines.

Course Outcomes:

After completion of the course students will able to:

CO1	Apply the principles of fluid mechanics in discharge measuring devices used in pipe channels and tanks (Apply-L3)
CO2	Analyze the performance of various hydraulic machines (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	2	2		3					1			2	2	2
CO2	2	2	2	3					1			2	2	2

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

PART - B
Detailed Schedule of Experiments

Exp. No	Date	BATCH - A						BATCH - B					CO	HOD Review
		A1	A2	A3	A4	A5		B1	B2	B3	B4	B5		
CYCLE 1														
Exp. No 1	Scheduled Date	02/11/21	30/11/21	23/11/21	16/11/21	09/11/21		05/11/21	10/12/21	03/12/21	26/11/21	12/11/21	CO1	
	Actual Date													
Exp. No 2	Scheduled Date	09/11/21	02/11/21	30/11/21	23/11/21	16/11/21		12/11/21	05/11/21	10/12/21	03/12/21	26/11/21	CO1	
	Actual Date													
Exp. No 3	Scheduled Date	16/11/21	09/11/21	02/11/21	30/11/21	23/11/21		26/11/21	12/11/21	05/11/21	10/12/21	03/12/21	CO1	
	Actual Date													
Exp. No 4	Scheduled Date	23/11/21	16/11/21	09/11/21	02/11/21	30/11/21		03/12/21	26/11/21	12/11/21	05/11/21	10/12/21	CO1	
	Actual Date													
Exp. No 5	Scheduled Date	30/11/21	23/11/21	16/11/21	09/11/21	02/11/21		10/12/21	03/12/21	26/11/21	12/11/21	05/11/21	CO1	
	Actual Date													
CYCLE 2														
Exp. No 6	Scheduled Date	21/12/21	18/01/21	11/01/22	04/01/22	28/12/21		24/12/21	28/01/22	21/01/22	07/01/22	31/12/21	CO1	
	Actual Date													
Exp. No 7	Scheduled Date	28/12/21	21/12/21	18/01/22	11/01/22	04/01/22		31/12/21	24/12/21	28/01/22	21/01/22	07/01/22	CO1	
	Actual Date													
Exp. No 8	Scheduled Date	04/01/22	28/12/21	21/12/21	18/01/22	11/01/22		07/01/22	31/12/21	24/12/21	28/01/22	21/01/22	CO2	
	Actual Date													
Exp. No 9	Scheduled Date	11/01/22	04/01/22	28/12/21	21/12/21	18/01/22		21/01/22	07/01/22	31/12/21	24/12/21	28/01/22	CO2	
	Actual Date													
Exp. No 10	Scheduled Date	18/01/22	11/01/22	04/01/22	28/12/21	21/12/21		28/01/22	21/01/22	07/01/22	31/12/21	24/12/21	CO1	
	Actual Date													
Internal Exam	Scheduled Date: 25-01-2022 Actual Date:							Scheduled Date: 04-02-2022 Actual Date:						

BATCH:A	BATCH:B
A_1 ----20765A5601, 02, 03, 04, 05 & 06	B_1 ---- 20761A5629, 30, 31, 32 & 33
A_2 -----20761A5607, 08, 09, 10, 11 & 12	B_2 ---- 20761A5634, 35, 36, 37 & 38
A_3 -----20761A5613, 14, 15, 16, 17 & 18	B_3 ---- 20761A5639, 40, 41, 42 & 43
A_4 ----- 20761A5619, 20, 21, 22 & 23	B_4 ----20761A5644, 45, 46, 47 & 48
A_5 ----- 20761A5624, 25, 26 & 27	B_5 – 20761A5650, 51, 52, 53, 54 & 55

LIST OF EXPERIMENTS

CYCLE I

1. Verification of Bernoulli's theorem
2. Calibration of Venturi meter
3. Calibration of orifice meter
4. Determination of friction factor for a given pipe line

5. Determination of co-efficient of discharge of rectangular notch

CYCLE II

1. Turbine flow meter
2. Impact of jet on vanes
3. Performance test on single stage centrifugal pump
4. Performance test on Kaplan turbine
5. Determination of co-efficient of discharge of given mouth piece

ACADEMIC CALENDAR:

Description	From	To	No. of Weeks
I Phase of Instructions-1	25-10-2021	11-12-2021	7
I Mid Examinations	13-12-2021	18-12-2021	1
II Phase of Instructions	20-12-2021	05-02-2022	7
II Mid Examinations	07-02-2022	12-02-2022	1
Preparation and Practical's	14-02-2022	19-02-2022	1
Semester End Examinations	21-02-2022	05-03-2022	2

PART – C

EVALUATION PROCESS:

Parameter	Marks
Day – to – Day Work	A1 = 5 Marks
Record	A2 = 5 Marks
Internal Test	B =5 Marks
Cumulative Internal Examination	**A1+ A2 + B = 15 Marks**
Semester End Examinations	**C = 35 Marks**
Total Marks: A1+ A2 + B + C	**50 Marks**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.

PEO2: To Function professionally in the rapidly changing world with advances in technology.

PEO3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.

PEO4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

PROGRAMME OUTCOMES (POs)

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

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

PO3:Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4:Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5:Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6:The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7:Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8:Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9:Individual and 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 the defense and space research programs

Course Instructor	**Module Coordinator**	**HOD**
Mr. I Dakshina Murthy/ Ms.M.Bhuvaneshwari	**Mr. I Dakshina Murthy**	**Dr.P.Lovaraju**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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DEPARTMENT OF AEROSPACE ENGINEERING

BRANCH: AEROSPACE **LAB: EFM (20AE63)**
COURSE: B.Tech (III Sem) **A.Y: 2021-22**

LABORATORY TIME TABLE

DAY	1 9.00 to 10.00	2 10.00 to 11.00	3 11.10 to 12.10	12.10 to 01.10	4 01.10 to 02.10	5 02.10 to 03.10	6 03.10 to 04.10
MON				LUNCH			
TUE					-- EFM LAB (Batch A) --		
WED							
THU							
FRI					-- EFM LAB (Batch B) --		
SAT							

BATCH:A	BATCH:B
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Faculty In charge (s) **Head of the Department**

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Faculty In charge (s) **Head of the Department**