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.P.Lovaraju
Course Name & Code : Aerodynamics –I & 17AE07
L-T-P Structure : 2-2-0 Credits : 3
Program/Sem/Sec : B.Tech, IV-Sem A.Y : 2019-20

PRE-REQUISITE: Engineering Fluid Mechanics

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

Course Outcomes: At the end of the semester, the student will be able to
CO1: Apply Laplace equation for obtaining 2D and axisymmetric solutions.
CO2: Apply conformal transformation to from aerodynamic shapes.
CO3: Apply potential flow theory to solve for airfoil characteristics.
CO4: Apply the Prandtl's lifting line theory to predict finite wing properties.
CO5: Analyze the effect of boundary layer on flow over objects.

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

Course Code	COs	Programme Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
17AE07	CO1	3	1	2	1	-	-	1	-	-	-	-	-	3	2
	CO2	3	3	3	3	-	-	1	-	-	-	-	-	3	3
	CO3	3	2	3	3	-	-	1	-	-	-	-	-	3	3
	CO4	3	3	3	2	-	-	1	-	-	-	-	-	3	3
	CO5	3	3	2	2	-	-	1	-	-	-	-	-	3	2
1 = Slight (Low) 2 = Moderate (Medium) 3-Substantial (High)															

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

TEXT BOOK
T1: Anderson, J.D., Fundamentals of Aerodynamics", McGraw-Hill Book Co., New York, 1998.

REFERENCES
R1: Rathakrishnan. E, Theoretical Aerodynamics, Wiley, 2013.
R2: Houghton. E. L., Carpenter P. W, Collicott. C. H, Valentine. D. T, Aerodynamics for Engineering students, Seventh Edition, Elseveir, 2017.
R3: Milne-Thomson. L. H., Theoretical aerodynamics, Courier Corporation, 2012.
R4: Clancy. J. L, Aerodynamics, Sterling Book House, 2006.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: POTENTIAL FLOW

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Overview of the course and course outcomes	1	25-11-2019		TLM1	
2.	Review of Fluid Mechanics and Introduction to the Potential flow	1	26-11-2019		TLM1	
3.	Basic Flows-Uniform parallel flow, Source and Sink Flows	1	27-11-2019		TLM1	
4.	Source and Sink Pair-Doublet	1	29-11-2019		TLM1	
5.	Combination of uniform flow and Source-Flow past half body	1	02-12-2019		TLM1, TLM5	
6.	Rankine oval	1	03-12-2019		TLM1, TLM5	
7.	Tutorial-1	1	04-12-2019		TLM3	
8.	Simple vortex, Flow over circular Cylinder without circulation	1	06-12-2019		TLM1	
9.	Simple vortex, Flow over circular Cylinder without circulation	1	09-12-2019		TLM1	
10.	Flow over circular Cylinder with circulation	1	10-12-2019		TLM1	
11.	Flow over circular Cylinder with circulation	1	11-12-2019		TLM1, TLM5	
12.	Kutta-Joukowsky Theorem	1	13-12-2019		TLM1	
13.	Tutorial-2	1	16-12-2019		TLM3	
14.	Assignment/Quiz - I	1	17-12-2019			
No. of classes required to complete UNIT-I: 14				No. of classes taken:		

UNIT-II: CONFORMAL TRANSFORMATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Conformal Mapping Introduction,	1	18-12-2019		TLM1	
2.	Basic Principles	1	20-12-2019		TLM1	
3.	Methods for Performing Transformation	1	23-12-2019		TLM1	
4.	Examples of Simple Transformation	1	24-12-2019		TLM1	
5.	Kutta-Joukowski Transformation,	1	27-12-2019		TLM1	
6.	Transformation of Circle to Straight Line	1	30-12-2019		TLM1	
7.	Transformation of Circle to Ellipse	1	31-12-2019		TLM1	
8.	Transformation of Circle to Symmetrical Aerofoil	1	01-01-2020		TLM1	
9.	Tutorial-3	1	03-01-2020		TLM3	
10.	Transformation of Circle to Cambered Aerofoil	1	06-01-2020		TLM1	
11.	Tutorial-4	1	07-01-2020		TLM3	
12.	Assignment/Quiz-2	1	08-01-2020			
13.	Revision	1	10-01-2020		TLM2	
No. of classes required to complete UNIT-II: 13				No. of classes taken:		

UNIT-III: THIN AEROFOIL THEORY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Aerofoil Theory	1	27-01-2020		TLM1	
2.	Airfoil Characteristics	1	28-01-2020		TLM1	
3.	Vortex Sheet	1	29-01-2020		TLM1	
4.	Kutta Condition, Kelvin's Circulation Theorem, Starting Vortex	1	31-01-2020		TLM1	
5.	Thin Aerofoil Theory and its applications	1	03-02-2020		TLM1	
6.	Application of thin aerofoil theory-Analysis of flow over symmetric airfoil	2	04-02-2020, 05-12-2020		TLM1	
7.	Application of thin aerofoil theory-Analysis of flow over cambered airfoil	2	07-02-2020, 10-02-2020		TLM1	
8.	Tutorial-5	1	11-02-2020		TLM3	
9.	Assignment/Quiz-3	1	12-02-2020			
No. of classes required to complete UNIT-III:11				No. of classes taken:		

UNIT-IV: FINITE WING THEORY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Finite Wing Theory-Introduction	1	14-02-2020		TLM1	
2.	Down wash and Induced drag, Trailing vortex	1	17-02-2020		TLM1	
3.	Vortex filament	1	18-02-2020		TLM1	
4.	Biot-Savart's law, Infinite and semi-infinite vortex filament	1	19-02-2020		TLM1	
5.	Helmholtz theorems	1	24-02-2020		TLM1	
6.	Horseshoe Vortex, Prandtl's Classical Lifting Line Theory	1	25-02-2020		TLM1	
7.	Elliptic Lift Distribution	1	26-02-2020		TLM1, TLM2	
8.	General Lift Distribution	2	28-02-2020, 02-03-2020		TLM1	
9.	Tutorial-6	1	03-03-2020		TLM3	
10.	Assignment/Quiz-4	1	04-03-2020			
No. of classes required to complete UNIT-IV: 11				No. of classes taken:		

UNIT-V : BOUNDARY LAYER

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Boundary Layer Development	1	06-03-2020		TLM1	
2.	Boundary layer Thickness, Boundary layer Displacement Thickness	1	09-03-2020		TLM1	
3.	Momentum Thickness, Energy Thickness	1	11-03-2020		TLM1	
4.	Types of Boundary layer, Momentum Integral Estimates	1	13-03-2020		TLM1	
5.	Karman Analysis of Flat plate	1	16-03-2020		TLM1	
6.	Tutorial-7	1	17-03-2020		TLM1	
7.	Navier Stokes Equations-Boundary Layer Equations-2D	1	18-03-2020		TLM1	
8.	Boundary layer growth on a Flat Plate, Blasius Solution	1	20-03-2020		TLM1	

9.	Boundary Layer with Pressure Gradient	1	23-03-2020		TLM1	
10.	Tutorial-8	1	24-03-2020		TLM3	
11.	Assignment/Quiz-5	1	27-03-2020			
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 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design
PSO 2	To prepare the students to work effectively in the defense and space research programs

Course Instructor	Module Coordinator	HOD
(Dr.P.Lovaraju)	(Dr.P.Lovaraju)	(Dr.B.Eswara Kumar)

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. L. Prabhu
Course Name & Code : Aircraft Structures – I / 17AE08
L-T-P Structure : 2-2-0 Credits : 3
Program/Sem/Sec : B.Tech., Aerospace, IV-Sem A.Y : 2019-20

PRE-REQUISITE: Engineering Mechanics, Strength of Materials

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the basic aspects of elasticity, characteristics of statically determinate and indeterminate structures, energy methods and theorem applicable to beams and trusses, behavior of columns under loading conditions.

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

CO 1	**Solve** problems related to elastic members by applying stress-strain relations
CO 2	**Analyze** the behavior of beams, frames and trusses under various loading conditions
CO 3	**Analyze** the statically indeterminate structures under various loading conditions
CO 4	**Evaluate** the strain energy stored in the structural members
CO 5	**Analyze** the buckling of columns and compressive member under various loading conditions

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	3	3	3	1	-	-	-	1	-	2	3	2	2	3
CO2	3	3	3	3	2	-	-	-	1	-	2	3	3	3	3
CO3	3	3	3	3	2	-	-	-	1	-	2	3	3	3	3
CO4	3	3	3	3	1	-	-	-	1	-	2	3	3	2	3
CO5	3	3	3	3	1	-	-	-	1	-	2	3	2	2	3

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

TEXT BOOKS:

T1 Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Vonostrand Co, 1990.
T2 Edward Arnold., Megson, T.M.G., "Aircraft Structures for Engineering Students", 2007.

REFERENCE BOOKS:

R1 Donaldson, B.K.,"Analysis of Aircraft Structures-An Introduction", McGraw-Hill, 1993.
R2 Bruhn.E.F."Analysis and design of flight vehicle structures" Tri set of offset Company, USA, 1973
R3 B.C.Punmia, "Theory of Structures", Laxmi Publication.
R4 S.Ramamrutham, R.Narayanan,"Theory of Structures"-Dhanpat Rai Publishing Co, 2003.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Basic Elasticity

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction To Course And Cos	1	27.11.2019		TLM1	
2.	Introduction To Unit-I, Basic Elasticity	1	28.11.2019		TLM1	
3.	Basic Elasticity Stresses and Strains	1	29.11.2019		TLM1	
4.	Equations Of Equilibrium	1	30.11.2019		TLM1	
5.	Determination of Normal and Tangential Stresses	1	04.12.2019		TLM1	
6.	Mohr's Circle-Graphical Method	1	05.12.2019		TLM1	
7.	**TUTORIAL-1**	1	06.12.2019		TLM3	
8.	Plane Stress, Plane Strain, Problems	1	07.12.2019		TLM1	
9.	Compatibility Equations, Stress - Strain Relations	1	11.12.2019		TLM1	
10.	Airy, Stress Function	1	12.12.2019		TLM1	
11.	**TUTORIAL-2**	1	13.12.2019		TLM3	
12.	Discussion, Quiz and Assignment - 1	1	18.12.2019		TLM1	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: Statically Determinant Structures

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to statically determinate structures	1	19.12.2019		TLM1	
2.	Determinacy and Stability	1	20.12.2019		TLM1	
3.	Beams, frames	1	21.12.2019		TLM1	
4.	Principle of Superposition	1	26.12.2019		TLM1	
5.	Reactions of supports of a frame	1	27.12.2019		TLM1	
6.	**TUTORIAL-3**	1	28.12.2019		TLM3	
7.	Analysis of plane truss-types of frame	1	02.01.2020		TLM1	
8.	Method of joints for simple frames	1	03.01.2020		TLM1	
9.	Method of joints for complex frames	1	04.01.2020		TLM1	
10.	Method of sections for simple and complex frames	1	08.01.2020		TLM1	
11.	**TUTORIAL-4**	1	09.01.2020		TLM3	
12.	Assignment/Quiz 2	1	10.01.2020		TLM1	
No. of classes required to complete UNIT-II:12				No. of classes taken:		

UNIT-III: Statically Indeterminate Structures

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Statically Indeterminate Structure	1	29.01.2020		TLM1	
2.	Double Integration Method	1	30.01.2020		TLM1	
3.	Propped cantilever - Point and UDL, SFD and BMD	1	31.01.2020		TLM1	
4.	**TUTORIAL-5**	1	01.02.2020		TLM3	
5.	Fixed-Fixed beams- Point and UDL, SFD and BMD	1	05.02.2020		TLM1	
6.	Continuous beams - Point and UDL,	1	06.02.2020		TLM1	

	SFD and BMD1					
7.	**TUTORIAL-6**	1	07.02.2020		TLM3	
8.	Clapeyron's Three Moment Equation	1	12.02.2020		TLM1	
9.	Moment Distribution Method	1	13.02.2020		TLM1	
10.	Relative Stiffness, Continuous Beams	1	14.02.2020		TLM1	
11.	Assignment/Quiz 3	1	15.02.2020		TLM1	
No. of classes required to complete UNIT-III:11				No. of classes taken:		

UNIT-IV: Energy Methods

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Strain Energy Due to Axial Loading, Bending	1	19.02.2020		TLM1	
2.	Strain Energy Stored By a Beam Subjected to Uniform Bending Moment	2	20.02.2020 22.02.2020		TLM1	
3.	Work Done By A Force on A Member-Law's of Reciprocal Deflections	2	26.02.2020 27.02.2020		TLM1	
4.	**TUTORIAL-7**	1	28.02.2020		TLM3	
5.	Castigliano's - First Theorem, Second Theorem	1	29.02.2020		TLM1	
6.	Maxwell's Reciprocal Theorem	1	04.03.2020		TLM1	
7.	Unit Load, Application to Beams and Trusses	1	05.03.2020		TLM1	
8.	**TUTORIAL-8**	1	06.03.2020		TLM3	
9.	Assignment/Quiz 4	1	07.03.2020		TLM1	
No. of classes required to complete UNIT-IV:11				No. of classes taken:		

UNIT-V: Columns

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction- Axially Loaded Compression Members	1	11.03.2020		TLM1	
2.	Axially Loaded Compression Members - Crushing Load-Buckling Load	1	12.03.2020		TLM1	
3.	Euler's theory-effective length	1	13.03.2020		TLM1	
4.	Expressions for Buckling Load with Different Column End Conditions	2	18.03.2020 19.03.2020		TLM1	
5.	**TUTORIAL-9**	1	20.03.2020		TLM3	
6.	Limitations-Euler's Formula-Rankine's Formula	1	21.03.2020		TLM1	
7.	Column with Initial Curvature	1	26.03.2020		TLM1	
8.	Columns Subjected to Eccentric Loading – Euler's Method- Rankine's Method	1	27.03.2020		TLM1	
9.	Assignment/Quiz 5	1	28.03.2020		TLM1	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To Apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design.
PSO 2	To Prepare the students to work effectively in the defense and space research programs.

Course Instructor	Course Coordinator	Module Coordinator	HOD
Dr. L. Prabhu	Dr. L. Prabhu	Dr. L. Prabhu	Dr. B. Eswara Kumar

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. Shaheda Niloufer
Course Name & Code : Environmental Science & 17FE03
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., IV-Sem., Section- A A.Y : 2019-20

PRE-REQUISITE:

COURSE EDUCATIONAL OBJECTIVES (CEOs): The purpose of this course is to provide a general background on developing an understanding of systems and cycles on the earth and how individual organisms live together in complex communities and how human activities influence our air, water and soil. It also helps in developing an understanding about our use of fossil fuels and effect on climate and sustainable management of natural resources.

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

CO 1	Identify environmental problems arising due to engineering and technological activities that help to be the part of sustainable solutions.
CO 2	Evaluate local, regional and global environmental issues related to resources and their sustainable management.
CO 3	Realize the importance of ecosystem and biodiversity for maintaining ecological balance.
CO 4	Acknowledge and prevent the problems related to pollution of air, water and soil.
CO5	Identify the significance of implementing environmental laws and abatement devices for environmental management.

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	3	-	-	-	3	3	3	-	-	-	3	-	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	3	-	-	-
CO3	3	-	3	-	-	-	2	-	-	-	-	2	-	-	-
CO4	3	-	-	-	-	2	3	2	-	-	-	3	-	-	-
CO5	3	3	3	3	-	3	3	3	-	-	-	3	-	-	-

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

TEXT BOOKS:

T1 Anubha Kaushik, C.P.Kaushik, "Perspectives in Environmental Studies", New age international publishers, 5th Edition, Delhi, 2016.

T2 Mahua Basu, S. Xavier, "Fundamentals of Environmental Studies", Cambridge University Press, 1st Edition, Delhi, 2016.

REFERENCE BOOKS:

R1 S. Deswal, A. Deswal, "A Basic course in Environmental Studies", Educational & Technical Publishers, 2nd Edition, Delhi, 2014.

R2 R. Rajagopalan, "*Environmental Studies (From Crisis to Cure)*", Oxford University Press, 2nd Edition, New Delhi, 2012.

R3 De, A.K, "Environmental Chemistry", New Age International (P) Limited, 5th Edition, New Delhi, 2003.

R4 Dr.K.V.S.G. Murali Krishna, "Environmental Studies", VGS Techno Series, 1st Edition, Vijayawada, 2010.

R5 G. Tyler Miller, Scott Spoolman, "Introduction to Environmental Studies", Cengage Learning, 13th Edition, New Delhi, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: NATURE AND SCOPE OF ENVIRONMENTAL PROBLEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction of course and course objectives. Introduction of components of Environment	1	25-11-2019		1,2	
2.	Scope and importance of environmental studies	1	27-11-2019		1,2	
3.	Population explosion and variations among Nations.	1	28-11-2019		1,2	
4.	Resettlement and Rehabilitation - Issues and possible solutions	1	2-12-2019		1,2	
5.	Environment and human health	1	4-12-2019		1,2	
6.	HIV-AIDS, Environmental ethics	1	5-12-2019		1,2	
7.	Role of Information Technology in environmental management and human health	1	9-12-2019		1,2	
8.	**Assignment in UNIT I**	1	11-12-2019		6	
9.	**Tutorial -1**	1	12-12-2019		3	
No. of classes required to complete UNIT-I: 9				No. of classes taken:		

UNIT-II: NATURAL RESOURCES AND CONSERVATION

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 classification of Natural resources	1	16-12-2019		1,2	
2.	Forest Resources, Assignment in Unit II	1	18-12-2019		1,2,6	
3.	Water Resources	1	19-12-2019		1,2	
4.	Water Resources	1	23-12-2019		1,2	
5.	**Tutorial-2**	1	26-12-2019		3	
6.	Mineral Resources	1	30-12-2019		1,2	
7.	Mineral Resources	1	02-01-2020		1,2	
8.	Food Resources	1	06-01-2020		1,2	
9.	Food Resources	1	08-01-2020		1,2	
10.	Energy Resources	1	09-01-2020		1,2	
11.	I MID EXAMINATION		20-01-2020			

12.	I MID EXAMINATION		22-01-2020			
13.	I MID EXAMINATION		23-01-2020			
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: ECOLOGY AND BIODIVERSITY

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.	Definition, structure and functions of an ecosystem Food chains and Food webs	1	27-01-2020		1,2	
2.	Ecological succession, Ecological pyramids	1	29-01-2020		1,2	
3.	Biogeochemical cycles, Major Types of Ecosystems – Forest, Grassland, Desert Land & aquatic Ecosystem, Ecological Niche and Keystone Species	1	30-01-2020		1,2	
4.	**Tutorial-3**	1	03-02-2020		3	
5.	Biogeographical classification of India. India as a mega diversity nation	1	05-02-2020		1,2	
6.	Values of biodiversity- Direct and Indirect values. Threats to biodiversity; Man and wild life conflicts. Endangered and endemic species of India	1	06-02-2020		1,2	
7.	Conservation of biodiversity: In-situ and Ex-situ conservation methods	1	10-02-2020		1,2	
8.	**Assignment Unit III**	1	12-02-2020		6	
9.	Cases of ecosystems		13-02-2020		1,2	
No. of classes required to complete UNIT-III: 9				No. of classes taken:		

UNIT-IV : ENVIRONMENTAL POLLUTION

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.	Causes, effects and control measures of: Water Pollution	1	17-02-2020		1,2	
2.	Causes, effects and control measures of: Soil Pollution	1	19-02-2020		1,2	
3.	**Tutorial-4**	1	20-02-2020		3	
4.	Causes, effects and control measures of: Noise Pollution	1	24-02-2020		1,2	
5.	Causes, effects and control measures of: Nuclear Pollution	1	26-02-2020		1,2	
6.	Solid Waste Management	1	27-02-2020		1,2	
7.	Environmental Issues relating to Climate change, global warming, acid rain, ozone layer depletion	1	02-03-2020		1,2	
8.	Disaster Management- Floods, Cyclones, Earthquakes, Landslides and Tsunamis.	1	04-03-2020		3	
9.	Sustainable development and unsustainability. **Assignment in Unit IV**	1	05-03-2020		1,2,6	

No. of classes required to complete UNIT-IV: 9	No. of classes taken:

UNIT-V : ENVIRONMENTAL MANAGEMENT

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.	Stockholm and Rio Summit	1	09-03-2020		1,2	
2.	**Tutorial-5**	1	11-03-2020		3	
3.	Environmental Impact Assessment (EIA),	1	12-03-2020		1,2	
4.	Green building	1	16-03-2020		1,2	
5.	**Assignment in UNIT- V**	1	18-03-2020		6	
6.	Consumerism and Waste products. Carbon credits and carbon trading.	1	19-03-2020		1,2	
7.	Environmental Law- Air, Water Acts	1	23-03-2020		1,2	
8.	Wild life, Forest, and Environmental protection act	1	26-03-2020		1,2	
9.	**II Mid Examination**		30-03-2020			
10.	**II Mid Examination**		01-04-2020			
11.	**II Mid Examination**		02-04-2020			
No. of classes required to complete UNIT-V: 8				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.

Dr. Shaheda Niloufer	**Dr. Shaheda Niloufer**	**Dr. Shaheda Niloufer**	**Dr. A. Rami Reddy**
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF AEEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: **Mr. G V SURYA NARAYANA**
Course Name & Code : **MANUFACTURING TECHNOLOGY-17MEAE06**
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., IV-Sem., A.Y : 2019-20

PRE-REQUISITE: NIL

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn primary manufacturing processes, working of basic machines and various operations to be performed and also about unconventional machining processes

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

CO1	To acquire knowledge of the basic aspects of casting process.
CO2	To know the various basic concepts of welding process.
CO3	To apply metal forming process and sheet metal operations in the manufacturing of products.
CO4	To apply various lathe operations to manufacture products.
CO5	To apply different types machining operations while manufacturing a product.
CO6	To apply different unconventional machining processes while manufacturing a product.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	1	-	-	-	-	-	-	-	-	2	-	3	3
CO2	1	1	3	-	-	-	-	-	-	1	2	-	3	3
CO3	1	-	3	2	-	-	1	-	-	1	-	-	3	3
CO4	3	3	2	-	2	-	-	-	-	-	-	-	3	3
CO5	3	3	2	-	-	-	-	-	-	-	-	-	3	3
CO6	-	2	2	3	2	-	-	-	-	-	-	-	3	3

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

TEXT BOOKS:

T1: 1. Ghosh. A, Malik. A. K, Manufacturing Science, Second Edition, East West Publisher, 2010.

T2: 2. Kalpakjain. S, Schmid. S. R, Manufacturing Processes for Engineering Materials, 6th Edition, Pearson Education, 2017.

REFERENCE BOOKS:

R1: 1. Rao. P. N, Manufacturing Technology, Volume 1, Tata McGraw-Hill, 2013.
R2: 2. Jain. R. K, Production Technology, Khanna Publishers, 2001.
R3: 3. Lindberg. R. A, Process and materials of manufacturing, Allyn and Bacon, 1990.
R4: 4. Sarma P C., A Textbook of Production Technology, S. Chand & Company Ltd, 2009.
R5: 5. Raghuvamsi. B.S, Workshop Technology, Volume-I, Dhanpat Rai and Sons, Delhi, 2001.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Manufacturing

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	**UNIT-I:** Introduction to Manufacturing	01	25/11/19		TLM1	
2	Historical perspective, Importance of manufacturing	01	26/11/19		TLM1	
3	Classification of manufacturing processes	01	28/11/19		TLM1, TLM2	
4	Engineering materials	01	29/11/19		TLM1, TLM2	
5	Casting: Steps involved in making a casting	01	03/12/19		TLM1, TLM5, TLM4	
6	Advantages of castings and its applications	01	05/12/19		TLM1, TLM2	
7	Pattern making, Types of patterns	01	06/12/19		TLM1, TLM2	
8	Materials used for patterns, pattern allowances and their constructions	01	10/12/19		TLM1	
9	principles of Gating, Gating ratio, types of raisers, casting defects	01	12/12/19		TLM1	
10	Special casting processes: 1.Centrifugal casting 2. Die casting	01	16/12/19		TLM1, TLM5	
11	3. Investment casting 4. Continuous	01	17/12/19		TLM1, TLM5	
12	Assignment-1/Quiz-1	01	19/12/19			
No. of classes required to complete UNIT-I		12		No. of classes taken:		

UNIT-II: Welding and other joining processes

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly

13.	Welding and other joining processes	01	20/12/19		TLM1	
14.	Classification of welding process,	01	23/12/19		TLM1	
15.	Types of welding	01	24/12/19		TLM1	
16.	welded joints and their characteristics,	01	27/12/19		TLM1	
17.	Principle and applications	01	30/12/19		TLM1	
18.	Gas welding, Arc welding	01	02/01/20		TLM1, TLM5, TLM4	
19.	welding defects, Inert gas welding,	01	03/01/20		TLM1, TLM5, TLM4	
20.	Tig and Mig welding	01	06/01/20		TLM1, TLM4	
21.	Friction welding, Induction welding	01	07/01/20		TLM1	
22.	Soldering and Brazing	01	09/01/20		TLM1	
23.	Assignment-2/Quiz-2	01	10/01/20			
No. of classes required to complete UNIT-II		11		No. of classes taken:		

UNIT-III: Metal forming processes

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	**Metal forming processes** Introduction	01	27/01/20		TLM1	
25.	Rolling fundamentals,	01	28/01/20		TLM1	
26.	Theory of rolling types of rolling mills and products	01	30/01/20		TLM1, TLM5	
27.	Principles of Forging, Tools and dies	01	31/01/20		TLM1	
28.	Types of Forging, Smith forging	01	03/02/20		TLM1, TLM2, TLM4	
29.	Drop forging, Drawing and its types Wire drawing	01	06/02/20		TLM1, TLM5	
30.	Tube drawing	01	07/02/20		TLM1	
31.	**Extrusion of metals:** Basic extrusion process and its characteristics, and piercing	01	10/02/20		TLM1, TLM5	
32.	Hot extrusion and Cold extrusion Forward extrusion and Backward extrusion,	01	11/02/20		TLM1, TLM5	

33.	Impact extrusion, Hydrostatic extrusion.	01	13/02/20		TLM1, TLM5	
34.	Assignment-3/Quiz-3	01	17/02/20			
No. of classes required to complete UNIT-III		11		No. of classes taken:		

UNIT-IV: Machining Processes

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
35.	**Machining Processes**: Introduction	01	18/02/20		TLM1, TLM5	
36.	Mechanism of chip formation,	01	20/02/20		TLM1, TLM5	
37.	Tool geometry, cutting tool	01	24/02/20		TLM1, TLM5	
38.	Tool wear- cutting materials	01	25/02/20		TLM1, TLM5	
39.	Tool life & machinability cutting fluids	01	28/02/20		TLM1, TLM5	
40.	Introduction to Lathe- working Principle of lathe and operations	01	02/03/20		TLM1, TLM5, TLM4	
41.	Assignment/Quiz- 4	01	03/03/20		TLM1, TLM5	
No. of classes required to complete UNIT-IV		07		No. of classes taken:		

UNIT-V: Machining operations

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.	**SHAPING, PLANNING, MILLING AND DRILLING MACHINES:** Principles of Working	01	06/03/20		TLM1, TLM2, TLM4	
43.	Principle Parts, Specifications, Classification	01	09/03/20		TLM1, TLM2	
44.	Comparison and Operations Performed.	01	12/03/20		TLM1, TLM2	
45.	**INTRODUCTION TO UNCONVENTIONAL MACHINING PROCESSES:** Need for Unconventional Machining Methods	01	13/03/20		TLM1, TLM5	
46.	Classification of Unconventional Machining Processes.	01	16/03/20		TLM1, TLM5	
47.	Abrasive Jet Machining	01	17/03/20		TLM1, TLM5	
48.	Ultrasonic Machining	01	19/03/20		TLM1,	

					TLM5	
49.	Electrical Discharge Machining	01	20/03/20		TLM1, TLM5	
50.	Laser Beam Machining.	01	23/03/20		TLM1, TLM5	
51.	Assignment/Quiz- 5	01	24/03/20			
No. of classes required to complete UNIT-V		10		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
52.	Advanced Manufacturing Technology	01	26/03/20		TLM1, TLM5	
53.	Advance welding process	01	27/03/20		TLM1, TLM5	
54.	Advance material removing process (CNC & NC Program)	01	27/03/20		TLM1, TLM5, TLM4	
		03		No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5

Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: To apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and 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	**Communication:** To apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design.
PSO 2	To prepare the students to work effectively in the defense and space research programs.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Mr. G V SURYA NARAYANA)	(Mr. G V Surya Narayana)	(Mr. I Dakshina Murthy)	(Dr. B. ESWER KUMAR)

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DEPARTMENT OF AEROSPACE ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Y.P.C.S. Anil Kumar
Course Name & Code : Probability & Statistics
L-T-P Structure : 3-2-0 Credits : 4
Program/Sem/Sec : B.Tech / IV semester / Academic Year :2019-20

PRE-REQUISITE: nil

COURSE EDUCATIONAL OBJECTIVES (CEOs): In this course the students are able to understand the applications of probability distributions. Also various sample tests in testing the hypothesis and correlation of bivariate random variables, regression of a bi-variate data.

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

CO1: Predict various probabilistic situations based on various laws of probability and random variables.
CO2: Distinguish among the criteria of selection and application of Binomial, Poisson, Normal and Exponential distributions.
CO3: Estimate the point and interval estimators of mean and proportion for the given Sample data.
CO4: Apply various sample tests like Z-test, t-test, F-test and χ^2-test for decision making regarding the population based on sample data.
CO5: Estimate the level of correlation, the linear relationship using the regression lines for the given bivariate data.

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

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

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

BOS APPROVED TEXT BOOKS:

T1 Miller & Freund's "Probability and Statistics for Engineers",8th edition. PHI, New Delhi,2011.
T2 S.C.Gupta, V.K.Kapoor, "Fundamentals of Mathematical Statistics", 11thEdition, Sultan Chand and sons, New Delhi,2014.

BOS APPROVED REFERENCE BOOKS:

R1 Jay L.Devore "Probability and Statistics for engineering and the sciences." , 8th edition, Cengage Learning india, 2012.
R2 B.V. Ramana, "Higher Engineering Mathematics", 1st Edition, TMH, New Delhi, 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I : Probability and Random Variables

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction class, course outcomes	1	25-11-19		TLM1	
2.	Introduction to the course	1	26-11-19		TLM1	
3.	Basic concepts of probability	1	27-11-19		TLM1	
4.	problems on basic probability	1	28-11-19		TLM1	
5.	problems on addition theorem	1	30-11-19		TLM1	
6.	Conditional probability	1	02-12-19		TLM1	
7.	Multiplication theorem, examples	2	03-12-19 04-12-19		TLM1	
8.	Independent events, theorems	1	05-12-19		TLM1	
9.	Problems on multiplication theorem, independent events	1	07-12-19		TLM1	
10.	Tutorial -1	1	09-12-19		TLM3	
11.	Baye's theorem, problems	2	10-12-19 11-12-19		TLM1	
12.	Random variables, Expections	1	12-12-19		TLM1	
13.	Problems on PMF	1	16-12-19		TLM1	
14.	Problems on PDF	1	17-12-19		TLM1	
15.	Tutorial-2	1	18-12-19		TLM3	
No. of classes required to complete UNIT-I: 17				No. of classes taken:		

UNIT-II: Probability Distributions

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Binomial Distribution- mean & variance	1	19-12-19		TLM1	
2.	Problems on Binomial distribution	2	23-12-19 24-12-19		TLM1	
3.	Fitting of binomial distribution	1	26-12-19		TLM1	
4.	Poisson distribution, mean and variance	1	28-12-19		TLM1	
5.	Problems on Poisson distribution	2	30-12-19 31-12-19		TLM1	
6.	Fitting of Poisson distributions	1	02-01-20		TLM1	
7.	Tutorial -3	1	03-01-20		TLM3	
8.	Normal distribution: mean & variance	1	04-01-20		TLM1	
9.	Problems on Normal Distribution	2	06-01-20 07-01-20		TLM1	
10.	Exponential distribution:	1	08-01-20		TLM1	
11.	Tutorial -3	1	09-01-20		TLM3	
No. of classes required to complete UNIT-II: 14				No. of classes taken:		

UNIT-III: Sampling distribution and Estimation

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Sampling distribution ,definitions	1	27-01-20		TLM1	
2.	Sampling distribution of mean, variance	1	28-01-20		TLM1	
3.	problems	1	29-01-20		TLM1	
4.	Problems on central limit theorem	2	30-01-20 03-02-20		TLM1	
5.	Sums and differences	2	04-02-20 05-02-20		TLM1	
6.	Tutorial-5	1	06-02-20		TLM3	
7.	Estimation	1	08-02-20		TLM1	
8.	Point and interval estimation	1	10-02-20		TLM1	
9.	Interval estimation of mean and proportions in large samples	2	11-02-20 12-02-20		TLM1	

10.	Interval estimation of mean in small samples	1	13-02-20		TLM1	
11.	Tutorial-6	1	15-02-20		TLM3	
No. of classes required to complete UNIT-III: 14				No. of classes taken:		

UNIT-IV : Tests of Hypothesis

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Testing of Hypothesis , definitions	1	17-02-20		TLM1	
2.	Z-test for means	2	18-02-20 19-02-20		TLM1	
3.	Z-test for proportions	2	20-02-20 22-02-20		TLM1	
4.	Tutorial-7	1	24-02-20		TLM3	
5.	t-test for means	2	25-02-20 26-02-20		TLM1	
6.	paired t-test	2	27-02-20 29-02-20		TLM1	
7.	F-test for variances	1	02-03-20		TLM1	
8.	χ^2-test for goodness of fit	2	03-03-20 04-03-20		TLM1	
9.	χ^2-test for independence of attributes	2	05-03-20 07-03-20		TLM1	
10.	Tutorial-8	1	09-03-20		TLM3	
No. of classes required to complete UNIT-IV: 16				No. of classes taken:		

UNIT-V : Correlation and Regression

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Simple Bi-variate Correlation	1	11-03-20		TLM1	
2.	Problems on Pearson's Correlation	2	12-03-20 13-03-20		TLM1	
3.	Regression lines	1	16-03-20		TLM1	
4.	Problems on Regression lines	2	17-03-20 18-03-20		TLM1	
5.	Properties of Regression coefficients	2	19-03-20 21-03-20		TLM1	
6.	Tutorial-9	1	23-03-20		TLM3	
7.	Problems on rank Correlation	1	24-03-20		TLM1	
8.	Problems on repeated ranks	1	25-03-20		TLM1	
9.	Revision	1	26-03-20		TLM1	
10.	Tutorial-10	1	28-03-20		TLM3	
No. of classes required to complete UNIT-V: 13				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5

Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Y.P.C.S.Anil Kumar)	(M.Rami Reddy)	(Dr.A.Rami Reddy)	(Dr.A.Rami Reddy)

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. B. Eswara Kumar
Course Name & Code : Thermal Engineering & 17AE05
L-T-P Structure : 2-2-0 Credits : 3
Program/Sem/Sec : B.Tech., ASE., IV-Sem. A.Y : 2019-20

PRE-REQUISITE: Thermodynamics

COURSE EDUCATIONAL OBJECTIVES (CEOs): To learn the working of different components in IC Engines, working of various air refrigeration systems, properties of moist air, various air conditioning systems, vapor power cycles and element of steam power plants.

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

CO 1	**Describe** the functions of various components and system of IC Engines.
CO 2	**Describe** the functions of Air Refrigeration systems
CO 3	**Analyze** the properties of moist air and method to condition the air
CO 4	**Differentiate** various methods to improve the performance of vapor power cycles
CO5	**Describe** the functions of various elements of Steam Power Plant

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

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

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

TEXT BOOKS:

T1 Rathore. M.M, Thermal Engineering, Tata McGraw-Hill Education, 2010.
T2 Eastop. T.D. McConkey. A, Applied Thermodynamics, Fifth Edition, Pearson Education, 2009.

REFERENCE BOOKS:

R1 Joel. R, Basic Engineering Thermodynamics, Fifth Edition, Pearson Education, 2008.
R2 Choudhury. T.R, Basic Engineering Thermodynamics, 2nd Edition, Tata McGraw-Hill, 2000.
R3 Nag. P.K, Power Plant Engineering, 3rd Edition, Tata McGraw-Hill, 2013.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Internal Combustion Engines

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 (includes COs)	1	25/11/2019		**TLM2**	
2.	Classifications of IC Engines	1	26/11/2019		**TLM1**	
3.	Components of SI and CI engines	1	28/11/2019		**TLM2**	
4.	2-Stroke and 4-Stroke Engines & Comparison	1	30/11/2019		**TLM2**	
5.	Valve and Port timing diagrams	2	02/12/2019 & 03/12/2019		**TLM2**	
6.	Air-Fuel mixture and Simple Carburettor	1	05/12/2019		**TLM1**	
7.	Fuel injection system in CI Engines and injector	2	07/12/2019 & 09/12/2019		**TLM2**	
8.	Ignition system	1	10/12/2019		**TLM2**	
9.	Engine lubrication systems	2	12/12/2019 & 16/12/2019		**TLM2**	
10.	Performance of IC Engines	3	17/12/2019, 19/12/2019 & 21/12/2019		**TLM1**	
11.	Tutorial - 1	1	23/12/2019		**TLM3**	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Refrigeration

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 Refrigeration-Types of refrigeration systems	1	24/12/2019		**TLM2**	
2.	Simple air cooling system	1	26/12/2019		**TLM1**	
3.	**Simple air evaporative cooling system**	1	28/12/2019		**TLM2**	
4.	Tutorial - 2	1	30/12/2019		**TLM3**	
5.	Boot strap air evaporative cooling system	1	31/12/2019		**TLM1**	
6.	Problems	2	02/01/2020 & 04/01/2020		**TLM1**	
7.	Reduced air Ambient air cooling systems	1	06/01/2020		**TLM1**	
8.	**Regenerative air cooling system**	1	07/01/2020		**TLM1**	
9.	**Problems**	1	09/01/2020		**TLM1**	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: Psychrometrics and Air-Conditioning

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	27/01/2020		**TLM1**	
2.	Properties of moist air	1	28/01/2020		**TLM1**	
3.	**Problems**	1	30/01/2020		**TLM1**	
4.	Tutorial – 4	1	01/02/2020		**TLM3**	

5.	Problems	1	03/02/2020		**TLM1**	
6.	**Psychrometric charts**	1	04/02/2020		**TLM2**	
7.	Problems	1	06/02/2020		**TLM1**	
8.	Air conditioning processes	1	10/02/2020		**TLM1**	
9.	**Types of A/C systems**	1	11/02/2020		**TLM1**	
10.	Summer Air Conditioning	1	13/02/2020		**TLM1**	
11.	Winter Air Conditioning	1	15/02/2020		**TLM1**	
12.	Year Round Air Conditioning	1	17/02/2020		**TLM1**	
13.	Problems	1	18/02/2020		**TLM1**	
14.	Tutorial - 5	1	20/02/2020		**TLM3**	
No. of classes required to complete UNIT-III:				No. of classes taken:		

UNIT-IV: Vapor Power 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
1.	Introduction to Vapor power cycles	1	22/02/2020		**TLM1**	
2.	Carnot Vapor Power Cycle	1	24/02/2020		**TLM1**	
3.	**Ranine Vapor Power Cycle**	1	25/02/2020		**TLM1**	
4.	Comparison of Carnot and Rankine Vapor Power Cycles	1	27/02/2020		**TLM1**	
5.	Actual Vapor Power Cycles	1	29/02/2020		**TLM1**	
6.	**Tutorial – 6**	1	02/03/2020		**TLM3**	
7.	Efficiency of Rankine cycle	1	03/03/2020		**TLM1**	
8.	Effect of operating parameters on the Efficiency of Rankine cycle	1	05/03/2020		**TLM1**	
9.	**Reheat Rankine Cycle**	1	07/03/2020		**TLM1**	
10.	Regenerative Rankine Cycle, Super critical Rankine Cycle	1	09/03/2020		**TLM1**	
11.	Tutorial – 7	1	12/03/2020		**TLM3**	
12.	Problems	1	16/03/2020		**TLM1**	
No. of classes required to complete UNIT-IV:				No. of classes taken:		

UNIT-V: Steam Power Plant

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 Boilers-Fire tube and Water tube boilers	1	17/03/2020		**TLM2**	
2.	Steam nozzles, Flow through steam nozzle	1	19/03/2020		**TLM1**	
3.	**Steam Turbines – Classification, working principle**	1	21/03/2020		**TLM1**	
4.	Tutorial – 8 & Impulse turbine	1	23/03/2020		**TLM3**	
5.	Reaction turbine & Problems	1	24/03/2020		**TLM1, TLM3**	
6.	**Velocity Triangles &** Compounding	1	26/03/2020		**TLM1, TLM2**	
7.	Tutorial - 9	1	28/03/2020		**TLM1**	
No. of classes required to complete UNIT-V:				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To Apply the knowledge of Aerodynamics, Propulsion, Aircraft structures and Flight Dynamics in the Aerospace vehicle design.
PSO 2	To Prepare the students to work effectively in the defense and space research programs.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Name)	(Name)	(Name)	(Name)