

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE215	AIRCRAFT STRUCTURAL MECHANICS	1	2	2	3

Course Category:

Programme core

a. Preamble:

Aircraft Structural mechanics deals with the linear and static analysis of determinate and indeterminate aircraft structural components. The course contents have been designed such that the students get familiar with the fundamental aspects of different types of beams and columns subjected to various types of loading and support conditions with particular emphasis on aircraft structural components. Also provide the design process using different failure theories.

b. Prerequisite Courses:

- Strength of Materials

c. Related Courses:

- Aircraft structural analysis
- Aircraft structures Laboratory
- Finite element Methods
- Theory of elasticity
- Theory of vibrations

d. Course Educational Objectives:

- To understand the structural behavior of different types of beams and columns subjected to various loading conditions with particular emphasis on aircraft structural components.
- To provide the knowledge of various failure theories

e. Course Outcomes:

Upon the successful completion of this course students will be able to

CO Nos.	Course Outcomes	Level of learning domain (Based on revised Bloom's)
CO1	Analyze the statically determinate structures.	K3, S3
CO2	Analyze the statically indeterminate structures.	K3, S3
CO3	Apply strain energy theorems on structural members	K3
CO4	Examine the columns with various end conditions.	K2, S3
CO5	Explain the design process using various theories of failure.	K2

f. CORRELATION OF COS WITH PROGRAMME OUTCOMES:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		H		L	H	H	L			
CO2	H	L		H		L	H	H	L			
CO3	H	L		H		L	H	H	L			
CO4	H	L		H		L	H	H	L			

CO5	H	L		H		L	H	H	L			
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H- High; M-Medium; L-Low

Course Contents:

UNIT I -STATICALLY DETERMINATE STRUCTURES

L - 6 T - 6

Review of Basic Strength of materials - Analysis of plane truss – Method of joints – 3 D Truss - Plane frames - Composite beam

UNIT II STATICALLY INDETERMINATE STRUCTURES

L - 6 T - 6

Propped Cantilevers-- fixed- fixed beam- Clapeyron's Three Moment Equation - Moment Distribution Method.

UNIT III ENERGY METHODS

L - 6 T - 6

Strain Energy due to axial, bending and torsional loads - Castigliano's theorem - Maxwell's Reciprocal theorem, Unit load method - application to beams, trusses, frames, rings, etc.

UNIT IV COLUMNS

L - 6 T - 6

Columns with various end conditions – Euler’s Column curve – Rankine’s formula - Column with initial curvature - Eccentric loading – South well plot – Beam column.

UNIT V FAILURE THEORY

L - 6 T - 6

Ductile and Brittle Materials Maximum Stress theory – Maximum Strain Theory – Maximum Shear Stress Theory – Distortion Theory – Maximum Strain energy theory and simple problems of shaft under combined loading.

Total Periods: 45+30=75

List of Experiments

1. Determination of Young’s Modulus of steel using mechanical extensometers.
2. Determination of Young’s Modulus of Aluminium using electrical strain gauges.
3. Deflection of beams with various end conditions.
4. Verification of Maxwell’s Reciprocal theorem
5. Verification of principle of superposition.
6. Column – testing.
7. South – well’s plot.

h. Learning Resources

i. Text Books:

1. James M. Gere, Timoshenko, “Mechanics of Materials” 2nd edition, CBS Publisher,2006
2. Timoshenko, S., “Strength of Materials”, Vol. I and II, Princeton D. von Nostrand Co, 1990.

ii. References:

1. Donaldson, B.K., “Analysis of Aircraft Structures – An Introduction”, McGraw-Hill, 1993.
2. Bruhn.E.F.” Analysis and design of flight vehicle structures” Tri set of offset Company, USA, 1973.
3. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.