

COURSE CODE	COURSE TITLE	L	T	P	C
1151AE216	AIRCRAFT STRUCTURAL ANALYSIS	1	2	2	3

Course Category:

Programme core

a. Preamble:

This course provides an introduction to the basic analysis of aircraft components such as ribs, bulk heads and stringers. It introduces the phenomenon of analysis of plate structure

b. Prerequisite Courses:

- Aircraft structural mechanics

c. Related Courses:

- Nil

d. Course Educational Objectives:

- To develop the analytical knowledge of the students in the area of aircraft structural components.
- To prepare students for designing structural elements of the wing and fuselage sections with minimum weight and to know the behaviour of various aircraft structural components under different types of loads.

e. Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Analyze the bending stress in different section with various methods	K4,S3
CO2	Understand the importance of shear center and shear flow and analyze shear flow of various open section	K3,S3
CO3	Develop the concept of torsion and shear flow due to and analyze shear flow of various closed section	K3,S3
CO4	Analyze plates and sheets under buckling and find out the strength of stiffener panel	K4,S3
CO5	Analyze the aircraft wing components like ribs and calculate the properties structural elements of an aircraft and derive the effects various loads on the aircraft structural components	K5,S3

f. Correlation of COs with POs:

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	L		H			H	H	L			
CO2	H	L		H			H	H	L			
CO3	H	L		H			H	H	L			
CO4	H	L		H			H	H	L			
CO5	H	L		H			H	H	L			

H- High; M-Medium; L-Low

g. Course Contents:

UNIT-I UNSYMMETRICAL BENDING

L-6 T-6

Bending of symmetric beams subject to skew loads - bending stresses in beams of unsymmetrical sections – generalized ‘k’ method, neutral axis method, and principal axis method.

UNIT-II SHEAR FLOW IN OPEN SECTIONS

L - 6 T - 6

Thin walled beams, Concept of shear flow, shear Centre, Elastic axis. With one axis of symmetry, with wall effective and ineffective in bending, unsymmetrical beam sections, structural idealization, Shear flow variation in idealized sections.

UNIT-III SHEAR FLOW IN CLOSED SECTIONS

L - 6 T - 6

Bredth – Batho formula, Single and multi – cell structures. Approximate methods. Shear flow in single & multicell structures under torsion. Shear flow in single and multicell under bending with walls effective and ineffective.

UNIT-IV BUCKLING OF PLATES

L - 6 T - 6

Rectangular sheets under compression, Local buckling stress of thin walled sections, Crippling stresses by Needham’s and Gerard’s methods, thin walled column strength. Sheet stiffener panels. Effective width, inter rivet and sheet wrinkling failures.

UNIT-V STRESS ANALYSIS IN WING AND FUSELAGE

L - 6 T - 6

Loads on an aircraft – the V-n diagram – shear force and bending moment distribution over the aircraft wing and fuselage and other types of wings and fuselage, thin webbed beam. With parallel and non-parallel flanges, monocoque and Semi-monocoque aerospace structures Shear resistant web beams, Tension field web beams (Wagner’s).

Total Periods: 45+30=75

List of Experiments

1. Unsymmetrical bending of beams
2. Shear center location for open sections
3. Shear center location for closed sections
4. Constant strength beam
5. Flexibility matrix for cantilever Plate
6. Beam with combined loading
7. Calibration of Photo- elastic materials
8. Stresses in circular discs and beams using photo elastic techniques
9. Wagner beam – Tension field beam

h.Learning Resource

i. Text Books:

1. T.H.G. Megson, “Aircraft Structures for Engineering Students”, 5th edition Butterworth-Heinemann, 2012
2. Bruhn.E.F.” Analysis and design of flight vehicle structures” Tri set of offset Company, USA, 1973.

ii. References:

1. C. T. Sun, “Mechanics of Aircraft Structures”, Wiley, 2nd edition, 2006
2. Donaldson, B.K., “Analysis of Aircraft Structures – An Introduction”, McGraw-Hill, 1993.
3. T.H.G. Megson, “Introduction to Aircraft structural analysis”, 2nd edition, Butterworth-Heinemann, 2013
4. Peery, D.J., and Azar, J.J., Aircraft Structures, 2nd edition, McGraw – Hill, N.Y., 1999.

5. Howard D Curtis, „Fundamentals of Aircraft Structural Analysis“, WCB-McGraw-Hill, 1997
6. David H. Allen, Walter Haisler, “Introduction to Aerospace Structural Analysis”, John wiley and sons, 1985
7. Rivello, R.M., Theory and Analysis of Flight Structures, McGraw Hill, 1993.