



GUJARAT TECHNOLOGICAL UNIVERSITY

Bachelor of Engineering
Subject Code: 3140101
Semester –IV
Subject Name: Aircraft Structures

Type of course: Professional core course

Prerequisite: Mechanics of Solids, Fundamentals of Aeronautical engineering

Rationale: Aero Structure is useful to apply fundamental principal of Mechanics to solve various field problems at elementary level.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	2	5	70	30	30	20	150

Content:

Sr. No.	Content	Total Hrs	Weightage
1	Structural Components of Aircraft and Airworthiness: Basic Construction Techniques: Airframe and Specific Components along with their Functions, Materials, Airframe Loads: Types of Load on Aircraft And its Parts in Flight, Factors of safety-flight envelope, Load factor determination, Fatigue, Safe life and fail-safe structures.	9	15%
2	Statically Determinate & Indeterminate Structures: Basic Concept of Determinate And Indeterminate Structure, Plane Truss Analysis – Method of Joints – Method of Sections, Deflection of Beams; Area Moment Method, Slope-Deflection Method, Moment Distribution Method, Stresses And Strains, Equations of Equilibrium, Plane Stress And Plane Strain Problems, Compatibility Equations, Stress - Strain Relations.	10	16%
3	Virtual Work, Energy and Matrix Methods: Work, Principle of Virtual Work and its Applications, Strain and Complementary Energy, Unit Load Method, Flexibility method, The Reciprocal Theorem, Temperature Effects, Stiffness method	8	14%
4	Bending of Open and Closed, Thin-Walled Beams: Symmetrical Bending, Unsymmetrical Bending, Deflection due to Bending, Calculation of Section Properties, Applicability of bending theory.	6	10%
5	Shear of beams: General stress, strain and displacement relationships for open and single cell closed section thin-walled beams, Shear of open section beams, Shear of closed section beams.	6	10%
6	Torsion of beams: Introduction to torsion of solid sections, torsion of open and closed section beams.	5	08%



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7	Thin Plate Theory: Bending of thin plates, Pure bending of thin plates, Plates subjected to twisting and bending, Plates subjected to distributed transverse load, Combined bending and in-plane loading of a thin rectangular plate, Bending of thin plates having a small curvatures, Energy method for bending of thin plates.	6	10%
8	Structural Instability: Columns: Euler buckling of columns, Inelastic buckling, Effect of initial imperfections, Stability of beam under transverse and axial loads, Energy method for the calculation of buckling loads in columns, Flexural-torsional buckling of thin-walled columns Thin Plates: Buckling of thin plates, Inelastic buckling of plates, Experimental determination of critical load for a flat plate, Local instability, Instability of stiffened panels, Failure stress in plates and stiffened panels, Tension field beams	10	17%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
20%	30%	30%	10%	10%	0

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and Above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Aircraft Structures for Engineering Students -T H G Megson, Elsevier Publishing
2. Aircraft Structures –Lakshmi Narasaiah, CRC Press
3. Analysis of Structure Vol. II:S. S. Bhavikatti, Vikas Publishing
4. Mechanics of Aircraft Structures: C. T. Sun, Wiley-Interscience Publishing
5. Matrix Analysis of Framed Structures–Weaverand Gere, Springer Publishing
6. Flying on your own wings. Chris Heintz, Trafford publishing

Course Outcomes:

After completion of this course students shall be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Demonstrate the structural components of aircraft and load applications.	19
CO-2	Evaluate stress analysis of statically determinate and indeterminate structures.	22



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CO-3	Estimate bending and twisting of thin plates.	19
CO-4	Analyse structural instability of columns and thin plates.	22
CO-5	Apply virtual work and matrix methods to solve various structural problems.	18

List of Experiments:

1. Stress analysis of a truss by using software.
2. Stress analysis of a cantilever column by using software.
3. Stress analysis of a pinned column by using software.
4. Stress analysis of a column with both ends fixed by using software.
5. Analysis of determinate beams.
6. Buckling of column.
7. Examples on Shear Centre.
8. Examples on Torsion of solid section and thin walled sections.
9. Matrix method: Analysis of Beam using Stiffness and flexibility method.
10. Analysis of Truss
11. Analysis of asymmetric and symmetric bending.
12. To perform Maxwell Reciprocal Theorem on different types of beam.

Major Equipment: Basic apparatuses of Engineering Mechanics and Software

List of Open Source Software/learning website: <https://nptel.ac.in/course.php>