

GUJARAT TECHNOLOGICAL UNIVERSITY

AERONAUTICAL ENGINEERING (01)

AIRCRAFT STRUCTURES I

SUBJECT CODE: 2140101

B.E. 4th SEMESTER

Type of Course: Engineering Science

Prerequisite: Basic concept of Engineering Mechanics and Strength of Material

Rationale: Aero Structure – I is useful to apply fundamental principal of Mechanics to solve various field problem 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)		
				PA	ALA	ESE	OEP			
3	1	0	4	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Module Weightage
1	Unit – 1 : Introduction of structure and structural analysis Types of Structure, basic concept of determinate and indeterminate structure, static and kinematic indeterminacy of structure, Introduction to stability of structure, Elastic theorems (Principal of superposition, Maxwell's Reciprocal Theorem), Principal of Virtual work.	6	15%
2	Unit – 2 : Slope and deflection of determinate beams Differential equation of the elastic curve, relation between moment-slope and deflection, Double Integration Method, Macaulay's method, Conjugate Beam Method, Moment area Method.	7	20%
3	Unit – 3: Analysis of perfect pin-jointed frames Classification of truss (simple truss, compound truss, complex truss). Analysis of statically determinate plane and space truss using Tension Co-efficient Method and Graphical Method. Identification of zero force members in truss.	5	15%
4	Unit – 4 : Strain Energy Concept of strain energy, resilience and proof resilience, strain energy due to axial load, bending, torsion, shear, sudden loads and impact load.	4	10%
5	Unit – 5 : column buckling Introduction to column buckling, slenderness ratio and effective length. Euler's theory for buckling of long column. Rankine formula.	5	10%
6	Unit – 6 : Theory of failure Maximum principal stress theory, Maximum shear stress theory, Maximum shear strain theory, Maximum strain energy theory, Maximum shear strain energy theory.	6	15%
7	Unit – 7 : Vibration of rigid body Terms related to rigid body vibration, D'alembert principal, single degree rigid body vibration using equilibrium approach and energy theorem.	6	15%

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks				
R Level	U Level	A Level	N Level	E Level
15%	25%	10%	25%	25%

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate 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 : David J Peery & J J Azar
2. Aircraft structures for Engg Students : THM Megson, Edward Arnold
3. Mechanics of Structure Vol. I : S. B. Junarkar
4. Theory of Elasticity : Tiamo Shenko
5. Analysis of Structure Vol. I : S. S. Bhavikatti
6. Introduction to Aerospace Structural analysis : David H Allen & Walter E Haisler
7. Mechanics of Aircraft Structures : C. T. Sun
8. Strength of Material & theory of structure : B. C. Punmia
9. Engineering Mechanics : Desai & Mistry
10. Engineering Mechanics : Hibbler

Course Outcomes:

After successful completion of the course students should be able to:

- 1 To know about how to convert field problem in to mathematical model for analysis.
- 2 To learn how to apply basic principal of engineering mechanics and mechanics solids for structural analysis at basic level.

List of Tutorial:

1. Indeterminacy of structure
2. Analysis of determinate beams using principal of virtual work
3. Deflection of beam.
4. Buckling of column.
5. Strain energy.
6. Theory of failure.
7. Column Buckling

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.