



# AMITY UNIVERSITY

— UTTAR PRADESH —

**Course Title: AIRCRAFT STRUCTURES - I**

**Credit Units: 05**

**Course Code: AERO204**

**Course Level: UG**

L	T	P/ S	SW/F W	TOTAL CREDIT UNITS
3	1	2	-	5

### Course Objectives

In this course, aerospace students will learn the concepts and basic structural analysis of 2-D members in Cartesian and Polar coordinates using various methods. Students will also understand the analysis of torsional loads on bars, shells and walled tubes as well as the analysis of statically indeterminate structures.

**Pre-requisites:** Mechanics of solids

### Course Contents/Syllabus:

	Weightage (%)
<b>Module I : Analysis of 2D Problems</b>	<b>20</b>
<b>Descriptors/Topics :</b> Analysis of 2-D problems in rectangular and polar co-ordinates employing “Theory of Elasticity: Plane Stress and Plane Strain Condition”.	
<b>Module II : Structural Analysis Method</b>	<b>20</b>
<b>Descriptors/Topics :</b> Energy Method, strain energy, complimentary energy. The two Castiglino’s theorems and application to statically indeterminate system. Unit load method, principle of virtual work and virtual displacement, principle of superposition, reciprocal theorem.	
<b>Module III : Statically Indeterminate Structures</b>	<b>20</b>
<b>Descriptors/Topics :</b> Truss analysis with single and double redundancy, frames and rings. Torsion and bending of multi-cell box beams.	
<b>Module IV : Torsion</b>	<b>10</b>

<b>Descriptors/Topics :</b> Torsion of non-circular solid bars, warping, axially constrained stresses. Torsional deflection of non-circular shell, analysis of thick walled tubes.	
<b>Module V : Stress Diffusion</b>	<b>10</b>
<b>Descriptors/Topics :</b> The diffusion of stress in stiffened panels, the concept of shear lag.	
<b>Module VI : Structural Analysis of Wing &amp; Fuselage</b>	<b>20</b>
<b>Descriptors/Topics :</b> Analysis of typical semi-monocoque structures, distribution of concentrated loads in webs, loads on fuselage bulkhead, analysis of wing ribs. Shear flow in tapered webs.	

### Student Learning Outcomes:

- Analyze shear flow over various sections of aircraft components.
- Calculate and analyze various stresses under different loading conditions.
- Apply theory to calculate shear center of sections points of stress concentration.
- Apply energy method to real aircraft loading problems.
- Analyze indeterminate structures.

**Pedagogy for Course Delivery:** Session Plan / course-material uploading, Class-room teaching associated with assignments, Aircraft Structure Lab experiments & Report preparation, quiz, viva-voce and evaluation.

### Lab/ Practical details, if applicable:

#### List of Experiments:

- Determination of shear center of closed, open and I-sections.
- Verification of reciprocal theorem.
- Photo-elastic techniques:
- Theoretical basis of the technique, study of the apparatus and its working principles.
- Exercise on different problems.
- The shear gauge method of measuring strains and displacements. Application to cantilever beams.

**Assessment/ Examination Scheme:**

<b>Theory L/T (%)</b>	<b>Lab/Practical/Studio (%)</b>	<b>Total</b>
<b>80</b>	<b>20</b>	<b>100</b>

**Theory Assessment (L&T):**

<b>Continuous Assessment/Internal Assessment - 30</b>					<b>End Term Examination</b>
<b>Components (Drop down)</b>	<b>A</b>	<b>CT</b>	<b>S/V/Q</b>	<b>HA</b>	<b>70</b>
<b>Weightage (%)</b>	5	10	8	7	70

**Lab/ Practical/ Studio Assessment:**

	<b>Continuous Assessment/Internal Assessment</b>				<b>End Term Examination</b>	
<b>Components (Drop down)</b>	<b>PR</b>	<b>LR</b>	<b>V</b>	<b>A</b>	<b>EXP</b>	<b>V</b>
<b>Weightage (%)</b>	10	10	5	5	35	35

**Text & References:**

- S. Timoshanko and J.N., "Theory of Elasticity".
- David J. Perry, "Aircraft Structures", McGraw Hill Book Co. 1949.
- T.H.G. Megson, "Aircraft Structures for Engineering Students", Edward Arnold and Co., 2<sup>nd</sup> Ed, 1990.
- B.C. Nakra and K.K. Chaudhary, "Instrumentation Measurement and Analysis", Tata McGraw Hill, 2<sup>nd</sup> Ed, 1993.

**Any other Study Material:**

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