FLIGHT VEHICLE STRUCTURES

(CORE COURSE II)

I Semester: AEROSPACE ENGINEERING

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
B27602	CC	3	-	-	3	30	70	100
Contact Classes: 60	Tutorial Classes: Nil	Practical Classes: Nil			Total Classes: 60			

COURSE OBJECTIVES:

The students will be exposed to advanced topics in the analysis of flight vehicle structures

COURSE OUTCOMES:

The students will be able to solve complex problems in structural analysis of flight vehicles and participate in structural design

UNIT-I	**THIN PLATE THEORY, STRUCTURAL INSTABILITY IN THIN PLATES**	**Classes: 12**

Bending of thin plates: Pure bending of thin plates, Plates subjected to bending and twisting, Plates subject to distributed transverse load, Combined bending and in-plane loading of a thin rectangular plate, Bending of thin plates having a small initial curvature, Energy method for bending of thin plates; Structural Instability in Thin Plates: Buckling of thin plates, Inelastic buckling of plates, Experimental determination of critical loads for a flat plate, Local instability, Instability of stiffened panels, Failure stress in plates and stiffened panels, Tension field beams

UNIT-II	**BENDING, SHEAR AND TORSION OF THIN-WALLED BEAMS**	**Classes: 12**

Definition of beam, Types of beams, Concept of shear force and bending moment, Relation between Shear Force and Bending Moment rate of loading at a section of a beam. Shear Force and Bending Moment diagrams for cantilever simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads, Point of contra flexure.

UNIT-III	**FLEXURAL STRESSES, SHEAR STRESSES**	**Classes: 12**

Bending and Open Thin-Walled Beams: Symmetrical bending, Unsymmetrical bending, Deflections due to bending, Calculation of section properties, Applicability of bending theory, Temperature effects; Shear of Beams: General stress, strain and displacement relationships for open and single cell closed section thin-walled beams, Shear of open and closed section beams; Torsion of Beams: Torsion of closed and open section beams; Combined Open and Closed Section Beams: Bending, Shear, Torsion

UNIT-IV	**STRESS ANALYSIS OF AIRCRAFT COMPONENTS**	**Classes: 12**

Wing spars, Fuselages, Wings, Fuselage frames and wing ribs, laminated composite structures

UNIT-V	**SMART MATERIALS AND ADAPTIVE STRUCTURES**	**Classes: 12**

Smart Materials Technologies and Control Applications: Control requirements, Smart Materials-Piezoelectric elements, Electrostrictive elements, Magentostrictive transducers, Electrorheological fluids, Shape memory alloys, Fiber optic sensors, Applications of smart materials, Adaptive Structures: Adaptive aerospace structures-Structural Health Monitoring (SHM), Shape control and active flow, Damping of vibration and noise, Smart skins, Systems

Text Books:

Aircraft Structures for Engineering Students ,Fourth Edition, *T. H. G. Megson, Butterworth-Heinemann, Elsevier Ltd, 2007*

Reference Books:

1.Mechanics of Aircraft Structures, Second Edition, C. T. Sun, John Wiley & Sons, 2006

2. Theory and Analysis of Flight Structures, Robert M. Rivello, McGraw-Hill, 1969

3. Airplane Structural Analysis and Design, Earnest E. Sechler, Lois G. Dunn, Dover Publications, 1963.