ANALYSIS OF AIRCRAFT STRUCTURES

V Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIA	SEE	Total
AAEB14	Core	2	1	-	3	30	70	100
Contact Classes: 30	Tutorial Classes: 15	Practical Classes: Nil				Total Classes: 45		

OBJECTIVES:

The course should enable the students to:

I. The concepts of estimation of the endurance and failure mechanism of aircraft structural components for safe design.

II. The properties and analysis of composite structures for replacement of aluminium structures with composites for high strength to weight ratio.

III. The mechanism involved in thin walled closed and rectangular section beam subjected to torsion and Shear loads for design of modern aircrafts.

IV The concepts of Stresses and deflections of various open and closed section aircraft beam structures.

MODULE -I	FATIGUE OF AIRCRAFT STRUCTURE	Classes: 08

S.N. curves - Endurance limits - Effect of mean stress, Goodman, Gerber and Soderberg relations and diagrams - Notches and stress concentrations - Neuber's stress concentration factors - Plastic stress concentration factors - Notched S.N. curves.

MODULE -II	FRACTURE MECHANICS OF AIRCRAFT STRUCTURE	Classes: 10

Strength of cracked bodies - Potential energy and surface energy - Griffith's theory - Irwin - Orwin extension of Griffith's theory to ductile materials - stress analysis of cracked bodies - Effect of thickness on fracture toughness - stress intensity factors for typical geometries. Crack growth mechanisms.

MODULE -III	LAMINATED AIRCRAFT COMPOSITE STRUCTURES	Classes: 09

Classification and characteristics of composite materials - Fibrous, Laminated Particulate, Combinations of composite materials, Mechanical Behavior. Basic terminology-laminae, laminates, Manufacture – Initial form of constituent Materials, Layup, Curing, Strength and stiffness Advantages, Cost Advantages, and Weight Advantages.

Applications- Military, Civil Aircraft, Space and Automotive. Elastic constants of a simple lamina, Stress–strain relationships for an orthotropic ply(macro- approach), Thin-walled composite beams.

MODULE -IV	STRUCTURAL AND LOADING DISCONTINUITIES - CLOSED SECTION BEAMS	Classes: 09

General aspects, Shear stress distribution at a built-in end of a closed section beam, Thin-walled rectangular section beam subjected to torsion, Shear lag.

MODULE-V	STRUCTURAL AND LOADING DISCONTINUITIES - OPEN SECTION BEAMS	Classes: 09

I-section beam subjected to torsion, Torsion of an arbitrary section beam, Distributed torque loading, Extension of the theory to allow for general systems of loading, Moment couple (bimoment).

Text Books:

1. Prasanth Kumar, "Elements of fracture mechanics", Wheeter Publication, 1999.
2. Jones, R.M, "Mechanics of Composite Materials", Taylor & Francis, 2nd Edition, 2010.
3. T. H. G. Megson, "Aircraft Structures for Engineering Students", Butterworth-Heinemann Ltd, 5th Edition, 2012.

Reference Books:

1. Barrois W, Ripely, E.L., "Fatigue of Aircraft Structure", Pe/gamon press. Oxford, 1983.
2. B. K. Donaldson, "Analysis of Aircraft Structures" - An Introduction", McGraw Hill, 3rd Edition, 1993.
3. E. H. Bruhn, "Analysis and Design of Flight Vehicles Structures", Tri-state off set company, USA, 4th Edition, 1965.
4. S. Timoshenko, "Strength of Materials, Vols I and II", Princeton D. Von Nostrand Co., Reprint, 1977.
5. J E shigley, C R Mischke, R G Budynas, K J Nisbett, "Mechanical Engineering Design", McGraw Hill, 8th Edition, 2010.

Web References:

1. https://nptel.ac.in/courses/112101095/
2. https://www.scribd.com/doc/244154727/theory-of-structures-timoshenko-pdf

E-Text Books:

1. https://www.freeengineeringbooks.com/AeroSpace/Aircraft-Structures-Books.php
2. https://docs.google.com/file/d/0Bw8MfqmgWLS4RlNqaE1oUzdOajQ/view?pref=2&pli=1