COMPUTATIONAL STRUCTURAL ANALYSIS LABORATORY

VII Semester: AE

Course Code	Category	Hours / Week			Credits	Maximum Marks		
		L	T	P	C	CIE	SEE	Total
AAE111	Core	-	-	3	2	30	70	100
Contact Classes: Nil	Tutorial Classes: Nil	Practical Classes: 36				Total Classes: 36		

I. COURSE OVERVIEW:

Computational Structural Analysis Laboratory sessions focus on the creation of geometry, meshing (Discretization) and the physics behind the stress strain variation on a continuum. It will also cover the different solvers available in a FEA package and their applications based on the problem type.This course offers a wide range of applications in aircraft structural analysis such as deflection of truss, frames, beams, stress and strain distributions in a plate as well as a solid continuum. Apart from these, it will also address the nonlinear stress problems alongside vibration and flutter analysis.

II. OBJECTIVES:

The course should enable the students to:

I. Make the student familiar with latest computational techniques and software used for structural analysis.
II. Enable the student get a feeling of how real-life structures behavior for static and dynamics loads.
III. Become familiar with professional and contemporary issues in the design and fabrication.

III. COURSE OUTCOMES:

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

CO 1	**Explain** the computational methods and Software's that are used in aerospace fields to simulate the complex problems through ANSYS.	Understand
CO 2	**Solve** the parameters like deflections, stress, strain and bending moment by using ANSYS for the linear and non-linear problems that occur in aircraft structural components (beams, bars etc.).	Apply
CO 3	**Calculate** the numerical solution of static structural problems using discretization methods and convergence criteria to minimize the errors.	Analyze
CO 4	**Select** the appropriate heat transfer mechanism using ANSYS thermal workbench for efficient cooling of on board avionics system.	Analyze
CO 5	**Predict** the suitable appropriate results using governing equations for vibration problems that occur in aircraft structural components (beams, spring-mass system)	Evaluate
CO 6	**Determine** the nature of stress-strain distribution by using appropriate governing equations for an aircraft structural components such as wings, fuselage and landing gear.	Evaluate

IV. SYLLABUS:

LIST OF EXPERIMENTS

Week-l	**INTRODUCTION AND BASIC FUCTIONS**

a. Starting up of ANSYS/Nastran
b. Description of user interface

Week-2	**STATIC ANALYSIS: TRUSS AND FRAME STRUCTURES**

a. 2-D truss structures
b. 3-D truss structures

Week-3	**STATIC ANALYSIS: BEAMS**
a. Straight beams b. Tapered beams	
Week-4	**STATIC ANALYSIS: TWO DIMENSIONAL PROBLEMS**
a. 2-D structure with various loadings b. 2-D structures with different materials c. Plate with hole	
Week-5	**DYNAMIC ANALYSIS: MODAL AND TRANSIENT ANALYSES**
a. Modal analysis b. Transient Response (spring-mass system)	
Week-6	**THERMAL ANALYSIS**
a. Bars and beams b. 2D structures	
Week-7	**NON LINEAR ANALYSIS**
a. Nonlinear behavior (Large deflections) b. Nonlinear behavior (Materials)	
Week-8	**HARMONIC RESPONSE ANALYSIS**
a. Random Vibration Analysis of a Deep Simply-Supported Beam b. Harmonic Response of a Spring-Mass System	
Week-9	**ANALYSIS OF AIRCARFT STRUCTURE: WING**
a. Static analysis of Aircraft wing structure b. Modal analysis of aircraft wing structure	
Week-10	**ANALYSIS OF AIRCARFT STRUCTURE:FUSELAGE**
a. Static analysis of Aircraft Semi monoque fuselage structure b. Modal analysis of aircraft Semi monoque fuselage structure	
Week-11	**ANALYSIS OF AIRCARFT STRUCTURE:LANDING GEAR**
a. Static analysis of main landing gear b. Modal analysis of main landing gear	
Week-12	**ANALYSIS OF COMPOSITE STRUCTURES**
a. Static analysis of composite bar and beam b. Static analysis of composite plate	
Reference Books:	
1. Huei-Huang Lee, "Finite Element Simulations with ANSYS Workbench 16", SDC publications, 2nd Edition, 2016. 2. Anderson, William J "MSC/Nastran: Interactive Training Program" Wiley 1st Edition 2015.	
Web Reference:	
http://www.iare.ac.in	

Course Home Page:
SOFTWARE AND HARDWARE REQUIREMENTS FOR A BATCH OF 36 STUDENTS: **SOFTWARE:** ANSYS 16 or MSC Nastran **HARDWARE:** Desktop Computers with 4 GB RAM 36 nos