COURSE CONTENT

COMPUTATIONAL AEROSPACE ENGINEERING LABORATORY								
I Semester: AE								
Course Code	**Category**	**Hours / Week**			**Credits**	**Maximum Marks**		
BAEE12	Core	**L**	**T**	**P**	**C**	**CIA**	**SEE**	**Total**
		-	-	4	2	40	60	100
Contact Classes: Nil	**Tutorial Classes: Nil**	**Practical Classes: 45**				**Total Classes: 45**		
Prerequisite: Aircraft Structures								

I. COURSE OVERVIEW:

This course aims to enhance the skills through a detailed introduction to the state-of-the-art computational methods and their applications for digital age aerospace engineering applications. It provides a unique opportunity for cross-disciplinary education and knowledge transfer in the computational engineering of fluid and solid mechanics for aerospace industrial applications. Focusing on fully integrated digital design for aerospace applications, you will be able to understand and implement numerical methods on various computing platforms for aerospace applications

II. COURSE OBJECTIVES:

The students will try to learn:

I. The basic ANSYS software and use them to solve structural aero dynamic and flight control system problems.
II. Basics of plotting in ANSYS both in two dimensional and three dimensional.
III. Coding for solving structural response problems, aerodynamic simulation problems and flight control system analysis and design.

III. COURSE OUTCOMES:

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

CO 1 Develop the appropriate method for predicting ultimate load on wing using MATLAB.

C0 2 Make use of MATLAB and Simulink tools for solving aerospace engineering problem in designing.

CO 3 Examine the vibrational characteristics of various supported beams for obtaining structural stability.

CO 4 Make use of the structural fatigue concept for obtaining desired flexural characteristics.

CO 5 Analyze the effect of bending for failure rate of an aircraft structure.

CO 6 Determine the effect of Tortion during fracture of an aircraft component for assessing the structural stability.

IV. COURSE CONTENT:

Exercise -1: INTRODUCTION
MATLAB introduction, Plotting and graphics

Exercise -2: GENERATION OF STRUCTURES AND UNSTRUCTURED GRID
Generation of structured and unstructured grids are essential in the field of computational fluid dynamics (CFD) and finite element analysis (FEA).

Exercise -3: PLATE BENDING
Plate bending using finite element method.

Exercise -4: BEAMS ANALYSIS
Beams analysis using finite element method

Exercise -5: TRUSSES ANALYSIS
Trusses analysis using finite element method

Exercise -6: THIN SHELLS ANALYSIS
Thin shells analysis using finite element method

Exercise -7: FREE VIBRATION OF A CANTILEVER BEAM
Measurement of the natural frequencies of the cantilever beam, Observation of the damping effects in the beam's vibrations, Calculation of the time periods associated with each natural frequency.

Exercise -8: FORCED VIBRATION OF A CANTILEVER BEAM
Measurement of the frequency response of the cantilever beam, Determination of the relationship between the applied force's frequency and the beam's response amplitude at various excitation levels

Exercise -9: FREE VIBRATION OF A SIMPLY SUPPORTED BEAM
Measurement of the natural frequencies of the simply supported beam, Analysis of how the amplitude of vibration decays over time.

Exercise -10: FORCED VIBRATION OF A SIMPLY SUPPORTED BEAM
Measurement of the frequency response of the simply supported beam. Calculation of the dynamic stiffness of the simply supported beam.

Exercise -11: DETERMINATION OF ELASTIC CONSTANTS FOR A COMPOSITE FLEXURAL SPECIMEN
Determination of the flexural modulus, Use of strain gauges or other strain measurement devices to determine the strains experienced by the specimen during bending.

Exercise -12: COMBINED BENDING AND TORSION OF A HOLLOW CIRCULAR TUBE
Measurement of the load-deformation relationship for the hollow circular tube subjected to combined bending and torsion, Assessment of the combined stresses in the tube.

Exercise -13 SHEAR FORCE AND BENDING MOMENT DIAGRAMS- CANTILEVER BEAM
a. Calculating shear force and bending moment for point load.
b. Calculating shear force and bending moment for uniformly distributed load.
c. Calculating shear force and bending moment for uniformly varying load

Exercise -14 SHEAR FORCE AND BENDING MOMENT DIAGRAMS- OVER HANGING BEAM

a. Calculating shear force and bending moment for point load.
b. Calculating shear force and bending moment for uniformly distributed load.
c. Calculating shear force and bending moment for uniformly varying load

V. TEXT BOOKS:

1. Richard Colgren, "Basic MATLAB, Simulink, and State Flow", AIAA Education Series, 1st Edition, 2007.
2. Steven T. Karris, "Introduction to Simulink with Engineering Application", Orchard Publication, 3rd Edition, 2006.

VI. REFERENCE BOOKS:

1. Ashish Tewari, "Atmospheric and Space Flight Dynamics", Birkhauser Publication, 1st Edition, 2007.
2. A. Tewari, "Modern Control Design with MATLAB and Simulink", Wiley, 1st Edition, 2002.

VII. ELECTRONICS RESOURCES:

1. http://www.springer.com/us/book/9780817644376
2. https://www.scribd.com/doc/53680598/Modern-Control-Design-With-MATLAB-and-SIMULINK

VIII. MATERIALS ONLINE

1. Course template
2. Lab manual