EAS439 Numerical Analysis

Level: 4

Credit Units: 5 Credit Units

Language: ENGLISH

Presentation Pattern: EVERY JAN

Synopsis:

EAS439 Numerical Analysis teaches the students how to use numerical analysis for solving differential equations, which in the context of Aerospace design helps to obtain the relevant parameters regarding the structural implicit dynamics (e.g. stress and strain information) and the fluid related phenomenon (e.g. mass transfer, thermal analysis, etc.)
The first part of this course provides an introduction to numerical analysis. It covers the basic principles and theory on finite difference and finite volume methods. Classroom exercises will be conducted to help the students to understand the methodology of numerical methods used for solving ordinary differential equations.
The second part of this course covers the theory of finite element analysis (FEA) used in the context of structural analysis, which allows users to obtain information regarding the stress and strain for different structures involving linear and non-linear type of materials. This section also provides information on the application of FEA to different industries.
The last part of this course provides a fundamental understanding on computational fluid dynamics (CFD). Introduction of CFD analysis with different turbulence models will be covered.
Aside from the six seminars, six laboratory sessions are included in this course to provide the students the opportunity to practice by learning how to operate commercially available FEA and CFD software packages for real life structural and fluid related phenomenon.

Topics:

- Introduction to Numerical Methods
- Theory of Numerical Methods
- Industrial applications of Numerical Methods
- Introduction to Finite Element Analysis (FEA)
- Theory of Finite Element Analysis
- Industrial applications of FEA
- Linear and non-linear materials for FEA
- Introduction to Computational Fluid Dynamics (CFD) Analysis
- Theory of CFD Analysis
- Industrial applications of CFD
- Discretization Scheme
- Turbulence Modelling

Textbooks:

John D. Anderson, JR,: Computational Fluid Dynamics: The Basics with Applications, 2013 McGraw-Hill International editions
ISBN-13: 978-125902596

Steven C. Chapra, Raymond P.Canale: Numerical Methods for Engineers 2015 McGraw- Hill International editions.
ISBN-13: 978-007124429

Learning Outcome:

- Explain the methodology of numerical analysis to solve ordinary differential equation.
- Discuss the application of linear and non-linear type of materials in FEA.
- Evaluate the requirements and boundary conditions for FEA and CFD analysis.
- Formulate input data such as analysis data and boundary conditions for FEA and CFD analysis.
- Construct methods to carry out FEA analysis to obtain stress and strain information for different industrial applications.
- Design methods to carry out CFD analysis to obtain physical variables, such as pressure, velocity and temperature data for different industrial applications.
- Appraise solutions provided by commercially available FEA and CFD software.

Assessment Strategies:

Continuous Assessment Component	**Weightage (%)**
QUIZ	15
LAB REPORT	15
Sub-Total	**30**

Examinable Component	**Weightage (%)**
Written Exam	70
Sub-Total	**70**

Weightage Total	**100**