Syllabus of AS2070

Part A: Structural instability

1. Column buckling
   - Introduction
   - Critical load
   - Column buckling (Euler)
   - Effective length
   - Column buckling under eccentric loading
   - Secant formula and design approach
   - Inelastic buckling
   - Effect of initial imperfections
   - Beam stability under transverse and axial loads
   - Energy method for the calculation of buckling load in columns
   - Flexural – torsional buckling of thin walled columns
2. Bending of thin plates
   - Introduction
   - Plates subjected to bending and twisting
   - Plates subjected to distributed transverse load
   - Solution of bi-harmonic equation
3. Thin plates
   - Buckling of thin plates
   - Bending of thin plates having small initial curvature
   - Local instability and crippling

Part B: Composites

1. Introduction
   - Introduction
   - Mechanical behaviour of composite materials
   - Basic terminology in composites
   - Manufacturing of laminated fiber reinforced composites (FRC)
   - Current and potential advantages of FRC

2. Macromechanical behaviour of lamina
- Stress – strain relations for anisotropic materials
- Engineering constants for orthotropic materials
- Restrictions on elastic constants
- Lamina stress – strain relations
- Strength of an orthotropic lamina
- Biaxial strength theories for an orthotropic lamina

3. Micromechanical behaviour of a lamina
- Mechanics of materials approach to stiffness

4. Macromechanical behaviour of a laminate
- Classical laminate theory

Part C: Fracture and fatigue

1. Mathematical preliminaries
- Basics of complex numbers
- Cauchy-Riemann relation
- Fundamentals of fracture mechanics (FM)

2. Griffith's work
- Elastic strain energy
- Griffith's theory and fracture strength by Griffith
- Energy release rate and it's use in FM
- Pop-in phenomenon

3. Review of elasticity
- Displacement and stress formulations
- Plane stress and strain conditions in the context of FM

4. Different modes of fracture
- Mode -I, -II, III fracture
- Effect of plastic deformation on crack propogation

5. Fatigue
- Paris law

Reference books

1) Megson T. H. G., *Aircraft structures for engineering students*, Elsevier
2) Hibbeler, R. C., *Mechanics of materials*, Prentice hall
3) Gibson R., *Principles of composite material mechanics*, CRC press
4) Jones R. M., *Mechanics of composite materials*, HPC
5) Gdoutos E. E, *Fracture Mechanics An Introduction*, Springer.
6) Anderson T. L., *Fracture Mechanics: Fundamentals and Applications*, CRC Press.

Evaluation

Quiz 1: 20 %
Quiz 2: 20 %
Tutorials (at least 4): 10 %
End semester exam.: 50 %