**EME201 : MECHANICS OF SOLIDS**

|  |  |  |  |
| --- | --- | --- | --- |
| **L** | **T** | **P** | **C** |
| **3** | **1** | **0** | **4** |

**Course Objectives**

1. To introduce the concepts of different stresses, strains and their relations.
2. To locate principal planes in complex stress systems.
3. To draw SF and BM diagram of beam under different loading conditions.
4. To predict the maximum deflectionofbeams.
5. To analyse the stresses in components like shafts, springs and thin cylinders.
6. To calculate deflection of members using energy methods
7. To calculate crippling load of columns and struts.

**Course Outcomes**

Upon successful completion of the course, the student will be able to

1. identify the type of stresses in the axially loaded members.
2. analyse the stresses in beams.
3. design beams of uniform strength.
4. find the slope and deflection of the structural beam.
5. estimate the stress in members such as shaft springs and thin cylinder.
6. calculate deflection of members using energy methods
7. design the column and machine components for buckling.

**Module I 9 hours**

**Stresses and Strains:** Stress and strain, stress - strain relationship and elastic constants, axially loaded bars, compound bars, thermal stresses. Principal stresses and strains: Analysis of biaxial state of stress with and without shear - Mohr's Circle.

**Module II 9 hours**

**Analysis of Beams:** Shear force and bending moment diagram for cantilever, simply supported and overhanging beams for different types of loadings, relation between load, shearing force and bending moment. Theory of simple bending, bending stresses in beams, efficiency of various cross sections, shear stress distribution for different cross sections of beams.

**Module III 8 hours**

**Deflection of Beams:** Slope and deflection of beams, double integration method, Macaulay’s method, moment area method, strain energy method for cantilever, simply supported and overhanging beams.

**Module IV 8 hours**

**Torsion of Circular Shafts:** Theory of pure torsion, transmission of power in solid and hollow circular shafts, shafts in series and parallel, combined bending and torsion.

**Springs:** Axial load and torque on helical springs – stresses and deformations – strain energy.

**Thin Cylinders:** Thin cylinders, spherical shells subjected to internal fluid pressure.

**Module V 8 hours**

**Energy Methods:** Strain energy, strain energy density, elastic strain energy, impact loading, deflection under single load and several loads, Castigliano’s theorem.

**Columns and Struts**: Analysis of columns with different boundary conditions, Euler’s formula and its limitations, Rankine’s formula, columns under eccentric load.

**Text Books:**

1. F.P. Beer, E.R. Johnston, Jr&John.T. DeWolf, Mechanics of Materials (In SI Units), 4/e, Tata McGraw-Hill, 2013.
2. SS Rattan, Strength of materials, 2/e, Tata McGraw-Hill, 2011.

**References:**

1. Timoshenko, Strength of Materials Part-I & II, 3/e, CBS Publishers, 1986.
2. Popov, Mechanics of Solids, 2/e, Pearson Education, 2003.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| EME201  MECHANICS OF SOLIDS | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO 1 | 5 | 2 | 3 |  |  |  |  | 1 | 1 |  | 2 |  |
| CO 2 | 5 | 3 | 2 |  |  |  |  | 1 | 1 |  | 2 |  |
| CO 3 | 4 | 2 | 3 |  |  |  |  | 1 | 1 |  | 2 |  |
| CO 4 | 5 | 3 | 4 |  |  |  |  | 1 | 1 |  | 2 |  |
| CO 5 | 4 | 2 | 3 |  |  |  |  | 1 | 1 |  | 2 |  |
| CO 6 | 5 | 3 | 2 |  |  |  |  | 1 | 1 |  | 2 |  |