

Code: ME3T5

**II B.Tech - I Semester–Regular/Supplementary Examinations –  
November 2017**

**MECHANICS OF SOLIDS - I  
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

**PART – A**

Answer *all* the questions. All questions carry equal marks

11x 2 = 22 M

1. a) What is stress and what are the various types of stresses?
- b) What is elastic limit and elasticity?
- c) What is plane stress? Explain.
- d) What do you mean by principal planes and principal stresses?
- e) Define: (i) Proof resilience and (ii) toughness.
- f) What is Poission's ratio? Explain.
- g) Write the equations of equilibrium for statically determinate Bars.
- h) Draw the shear force and bending moment diagrams for a simply supported beam with a point load at center.
- i) Write the assumptions of simple bending.
- j) Write the section modulus for the circular cross section of diameter "d" and for square cross section of side "a".
- k) A cantilever beam of length 10 m is fixed at the left end and carries a point load at a distance of 3 m from the free

end. What are the values of shear forces at sections 1 m and 5 m from the free end?

### PART – B

Answer any **THREE** questions. All questions carry equal marks. 3 x 16 = 48 M

2. a) Derive the expression for a bar of circular section due to its self weight. 8 M

b) A bar 0.3 m long is 50 mm square in section for 120 mm of its length, 25 mm diameter for 80 mm and of 40 mm diameter for the remaining length. If a tensile force of 100 KN is applied to the bar, Calculate the maximum and minimum stresses produced in it, and the total elongation. Take  $E = 200 \text{ GN/m}^2$  and assume uniform distribution of load over the cross sections. 8 M

3. a) A prismatic bar in compression has a cross sectional area  $A = 1200 \text{ mm}^2$  and carries a load  $P = 90 \text{ KN}$ . Determine the stresses acting on a plane cut through the bar at  $25^\circ$  with horizontal. 6 M

b) The stresses on two perpendicular planes through a point in the body are 160 MPa and 100 MPa, both compressive along with a shear stress of 80 MPa. Determine 10 M

- i) Magnitude and orientation of principal stresses.
- ii) Magnitude and orientation of max. Inplane shear stress.

iii) Show the results diagrammatically.

4. a) A beam weighing 450 N is held in a horizontal position by three vertical wires, one attached to each end of the beam, one to the middle of its length. The outer wires are of brass of diameter 1.25 mm and the central wire is of steel of diameter 0.625 mm. If the beam is rigid and the wires are of same length and unstressed before the beam is attached, estimate the stresses induced in the wires. Take Young's modulus for brass as  $86 \text{ GN/m}^2$  and for steel  $210 \text{ GN/m}^2$ .

8 M

b) A steel bar 300 mm long, 50 mm wide and 12 mm thick is subjected to an axial pull of 84 kN. Find the change in length, width, thickness and volume of the bar. Take  $E = 200 \text{ GN/m}^2$  and the Poission's ratio = 0.32.

8 M

5. a) With reference to the type of supports classify the beams and define them.

4 M

b) A 10 m long simply supported beam carries two point loads of 10 kN and 6 kN at 2 m and 9 m respectively from the left end. It also has a uniformly distributed load of 4 kN/m run for the length between 4 m and 7 m from the left end. Draw the shear force and bending moment diagrams.

12 M

6. a) Derive the equation  $M/I = \sigma/y = E/R$

10 M

b) A circular beam 150 mm diameter is subjected to a shear force of 7 kN. Calculate the value of maximum shear stress, and sketch the variation of shear stress along the depth of the beam.

6 M