

Code: 20ME3402

II B.Tech - II Semester – Regular Examinations – JULY 2022

**STRENGTH OF MATERIALS
(MECHANICAL ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

Note: 1. This paper contains questions from 5 units of Syllabus. Each unit carries 14 marks and have an internal choice of Questions.
2. All parts of Question must be answered in one place.

UNIT – I

1. a) Draw stress strain diagram for structural steel and locate various important salient points on that. 6 M
- b) A mild steel bar of 200mm long and 50mmx50mm cross section is subjected to an axial compressive load of 200 kN. Taking poisson's ratio as 0.3 and $E = 210 \text{ kN/mm}^2$, calculate the changes in length, width and volume of the bar. Also calculate the values of shear and bulk moduli of the material of the bar. 8 M
- OR
2. a) What is meant by torsional rigidity? Explain its importance. 4 M
- b) A solid steel shaft has to transmit 100 kW at 160 r.p.m. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20%. 10 M

UNIT – II

3. A simply supported beam of 8 m length carries three point loads of 8 kN, 4 kN and 10 kN at 2 m, 5 m and 6 m respectively from the left end. Draw the shear force and bending moment diagrams. 14 M

OR

4. A cantilever of 14 m span carries loads of 6 kN, 4 kN, 6kN and 4 kN at 2 m, 4 m, 7 m, and 14 m respectively from the fixed end. It also has a uniformly distributed load of 2 kN/m run for the length between 4 m and 7 m from the fixed end. Draw the shear force and bending moment diagrams. 14 M

UNIT-III

5. A simply supported rectangular beam is 150mm wide by 300mm deep carries a distributed load of 8kN/m on a span of 3metres. Determine the maximum bending stress in the beam. 14 M

OR

6. Draw the shear stress distribution of rectangular section and prove that $q_{\max} = 1.5 q_{\text{mean}}$. 14 M

UNIT – IV

7. a) Write about double integration method with an example. 7 M
- b) A 3 meters long cantilever is loaded with a point load of 450 N at the free end. If the section is rectangular 80 7 M

mm (wide) x 160 mm (deep), and $E = 10 \text{ GN/m}^2$, calculate slope and deflection. i) at the free end of the cantilever, ii) at a distance of 0.55 m from the free end.

OR

8. a) Derive the expressions for longitudinal and hoop stress in a thin cylinder subjected to fluid pressure internally. 6 M
- b) A cylindrical thin drum 800 mm in diameter and 4 m long is made of 10 mm thick plates. If the drum is subjected to an internal pressure of 2.5 MPa, determine its changes in diameter and length. Take E as 200 GPa and Poisson's ratio as 0.25. 8 M

UNIT – V

9. A point is subjected to a tensile stress of 250 MPa in the horizontal direction and another tensile stress of 100 MPa in the vertical direction. The point is also subjected to a simple shear stress of 25 MPa, such that when it is associated with the major tensile stress, it tends to rotate the element in the clockwise direction. What is the magnitude of the normal and shear stresses on a section inclined at an angle of 20° with the major tensile stress? 14 M

OR

10. Derive an expression for the Euler's critical buckling load of a column with pinned ends. 14 M