



## End Term (Odd) Semester Examination November 2025

Roll no.....

Name of the Course and semester: B. Tech in Civil Engineering 3<sup>rd</sup> Sem

Name of the Paper: Mechanics of Solids

Paper Code: TCE 303

Time: 3-hour

Maximum Marks: 100

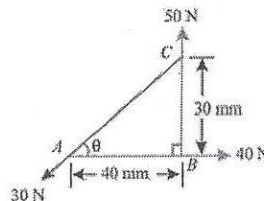
### Note:

- All the questions are compulsory.
- Answer any two sub questions from a, b and c in each main question.
- Total marks for each question are 20 (twenty).
- Each sub-question carries 10 marks.

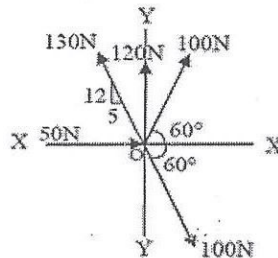
Q1.

(2X10=20 Marks)

- a. A triangle ABC has its side AB = 40 mm along positive x-axis and side BC = 30 mm along positive y-axis. Three forces of 40 N, 50 N and 30 N act along the sides AB, BC and CA respectively. Determine magnitude of the resultant of such a system of forces. (CO 1)



- b. Determine magnitude and direction of resultant force of the force system shown in fig (CO 1)



- c. Explain the principles of statics and derive the conditions of equilibrium for a system of concurrent forces in a plane. Illustrate with a neat sketch. (CO 1)

Q2.

(2X10=20 Marks)

- a. Explain the method of joints and the method of sections for the analysis of trusses. Describe the steps involved in finding member forces. (CO 2)
- b. A hollow cast-iron cylinder 4 m long, 300 mm outer diameter, and thickness of metal 50 mm is subjected to a central load on the top when standing straight. The stress produced is  $75000 \text{ kN/m}^2$ . Assume E as  $1.5 \times 10^8 \text{ kN/m}^2$  and find:
- Magnitude of load.
  - Longitudinal strain
  - Total decrease in Length. (CO 2)



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- c. The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long. Elongation with 40 kN load (within limit of proportionality), change in length = 0.0304 mm; Yield Load = 161 kN; Maximum Load = 242 kN; Length of specimen at fracture = 249 mm. Determine:

- I. Young's Modulus of Elasticity
- II. Yield Point stress
- III. Ultimate Stress
- IV. Percentage elongation. (CO 2)

Q3. (2X10=20 Marks)

- a. Draw the SFD and BMD for a cantilever of length L carrying a gradually varying load from zero at the free end to w per unit length at fixed end. (CO 3)
- b. A simply supported beam of 6 m span carries a UDL of 10 kN/m over the entire span and a point load of 20 kN at mid-span. Determine the support reactions, maximum bending moment, and draw the SFD and BMD neatly. (CO 3)
- c. What is Mohr's Circle? Describe the step-by-step construction of Mohr's Circle for Unlike Stress system. (CO 3)

Q4. (2X10=20 Marks)

- a. Derive the equation for shear stress distribution in beams with a suitable diagram. (CO 4)
- b. Find the Slope and Deflection at the free end for a Cantilever Beam with Concentrated Clockwise Moment at the free end. (CO 4)
- c. Derive the equation for Bending stress distribution in beams with a suitable diagram. (CO 4)

Q5. (2X10=20 Marks)

- a. A solid circular shaft of 60 mm diameter is subjected to a torque of 1200 N.m.  
Determine: (i) Maximum shear stress  
(ii) Angle of twist in a length of 2.5 m, given that,  $G=80\text{GPa}$ .  
Assume the shaft is under pure torsion. (CO 5)
- b. Derive the torsion equation, clearly stating the symbols and their units. Mention the conditions under which this equation is valid. (CO 5)
- c. State Euler's assumptions for long columns and derive the expression for the critical (buckling) load for a column with both ends pinned. (CO 5)