41N0302

Roll No.

Total No. of Pages.: 02

# 41N0302

## B.Tech IV Sem Main/Back (New Scheme) 2025-26

## Civil Engineering

## (4CE4-02) – Mechanics of Solids

**Time : 3 Hours**

**Maximum Marks: 70**
**Min. Passing Marks:**

Instructions to Candidates:

Part-A: Short answer questions (up to 25 words) 10x2 marks = 20 marks. All ten questions are compulsory.

Part- B: Analytical/Problem Solving questions 5x4 marks = 20 marks. Candidates have to answer 5 questions out of 7.

Part – C: Descriptive/Analytical/Problem Solving questions 3x10 marks = 30 marks. Candidates have to answer 3 questions out of 5.

Schematic diagrams must be shown wherever necessary. Any data you feel missing may suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.

Use of following supporting materials is permitted during examination. (Mentioned in form No. 205)

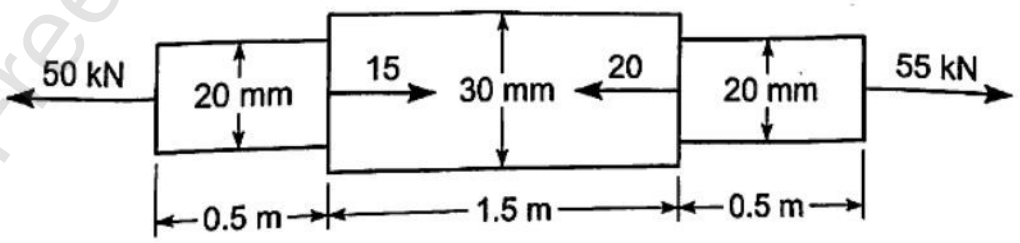
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### Part-A

| | | |
|---|---|---|
| Q.1. | Draw stress-strain diagram in tension for structural steel. | [2] |
| Q.2. | Define normal and shear stress. | [2] |
| Q.3. | What are thermal stresses? | [2] |
| Q.4. | Explain strain energy in torsion. | [2] |
| Q.5. | Explain shear force and bending moment. | [2] |
| Q.6. | Explain shear center. | [2] |
| Q.7. | Define principal stress. | [2] |
| Q.8. | What are propped cantilevers? | [2] |
| Q.9. | What is buckling? | [2] |
| Q.10. | What is effective length of columns? | [2] |

### PART-B

Q.1. A steel bar of variable section is subjected to forces as shown in diagram. Taking E = 205 kN/mm$^2$, determine the total elongation of the bar. [4]




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Q.2. Find the torque which a shaft of 200 mm diameter can safely transmit, if the shear stress is not to exceed 40 N/mm$^2$. [4]

Q.3. A beam 5 m long is simply supported at the ends and carries a uniformly distributed load of 20 kN/m. Draw the shear force and bending diagrams and determine the maximum bending moment. [4]

Q.4. A cantilever of length L carries a concentrated load w at the mid-span. If the free end in supported on a rigid prop, find the reaction at the prop. [4]

Q.5. What are the assumptions and limitations of Euler's buckling theory. [4]

## PART- C

Q.1. A straight bar of mild steel, 1m long and 10 mm x 6 mm in section is loaded axially till it buckles. Assuming Euler's formula for pinned ends to apply, estimate the maximum central deflection before the material attains its yield point of 300 N/mm$^2$. Take E = 2x10$^5$ N/mm$^2$. [10]

Q.2. At a point in a material, the stresses on two mutually perpendicular planes are 50 N/mm$^2$ (tensile) and 25 N/mm$^2$ (tensile). The shear stress across these planes is 10 N/mm$^2$. Using Mohr circle, find magnitude and direction of the resultant stress on a plane making an angle of 35$^0$ with the plane of the first stress. Also, find the normal and tangential stresses on this plane. [10]

Q.3. Derive the expression for volumetric strain due to single direct stress. [10]

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