Seat No. | | | | | | |

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मजल - 003

Strength of Materials
(113102)

P. Pages : 3

Time : Three Hours **Max. Marks : 80**

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub question from each unit.
5. Figures to the right indicate full marks.
6. Use of non programmable calculator is allowed.
7. Assume suitable data if necessary.

UNIT - I

1. a) i) Differentiate between compound and composite section. **4**

ii) Explain temperature stresses and temperature strains. **4**

b) Draw the stress-strain curve for mild steel, and give the name to important points on graph. Also determine the total elongation of bar having cross sectional area of 500 mm^2 is as shown in figure 1. **8**

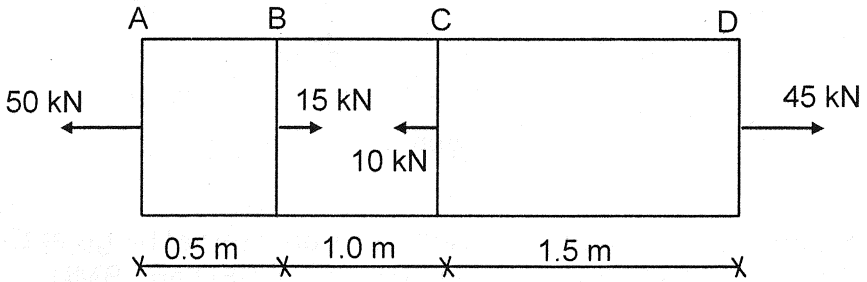

Figure 1

c) A steel rod 28 mm diameter and 500 mm long is subjected to axial force alternating between maximum compression of 20 kN and maximum tension of 15 kN. Find the difference between greatest and least length of rod. Take E = 200 kN/m^2. **8**

UNIT - II

2. a) Define the terms : Modulus of Elasticity, Modulus of Rigidity and Bulk Modulus. Derive the relationship between E, G and K from following given equations.

$E = 2G(1+\mu)$

and $E = 3K(1-2\mu)$ **8**

b) Define proof resilience and modulus of resilience. And show that stress produced due to suddenly applied load is twice that of due to gradually applied load. **8**

c) A load of 100 N falls through a height of 2 cm on to collar rigidly attached to the lower end of a vertical bar 1.5 m long and of 1.5 cm^2 cross sectional area. The upper end of the vertical bar is fixed. Determine :

i) Maximum instantaneous stress induced in bar.
ii) Maximum instantaneous elongation and
iii) Strain energy stored in the vertical rod. **8**

UNIT - III

3. a) i) Define 'Point of contraflexture'. Explain with illustrative example. **4**

ii) Draw SFD and BMD for the following beam loaded as shown in figure 2 below. **4**

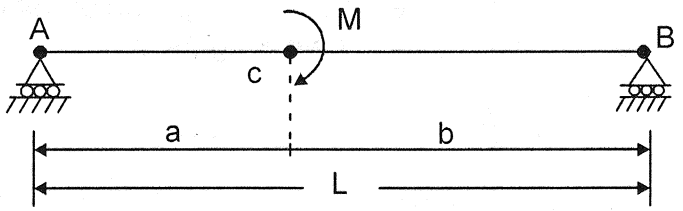

Figure 2

b) A beam ABC supported at A, B and C, has an internal hinge at E and is loaded as shown in figure 3 given below. Draw SFD and BMD. **8**

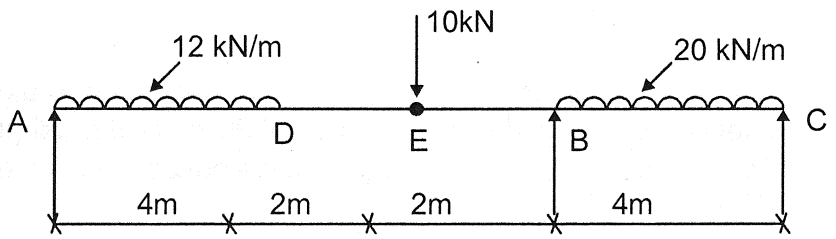

Fig. 3

c) A T - section of 200 x 15 mm Hange and 15 x 235 mm clear web is used as simply supported beam of span 4.0 m. If the bending stress in tension is not to exceed 150 MPa. Calculate maximum udl it can carry in addition to its self weight. **8**

UNIT - IV

4. a) Derive the relation $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{\ell}$ **8**

b) i) State the limitations of Euler's theory. **4**

ii) A hollow cast iron column is of 200 mm external diameter and 160 mm internal diameter. The column is 6m long and of which one end is fixed and other end is hinged. Take the factor of safety as 3 and E = 105 GPa. Use Eulers equation. **4**

c) A simply supported beam of 2m span carriers UDL of 140 kN/m on whole span. The cross section of T section is flange width 120 mm, thickness 20 mm throughout section and overall depth 160 mm. Determine the maximum shear stress and draw shear stress distribution diagram. **8**

UNIT - V

5. a) i) What is middle third rule ? Explain in detail for the rectangular section. **4**

ii) A Short cast iron column is tubular in section having 25 cm external diameter and 20 cm internal diameter. The column carries an eccentric compressive load of 250 kN at a distance 10 cm from its axis Determine the maximum tensile and compressive stresses. **4**

b) i) Explain direct and bending stresses in detail. **4**

ii) Explain Mohr's circle method of determining stresses on any oblique plane. **4**

c) A rectangular element in a strained element is subjected to tensile stress of 200 N/mm^2 and 150 N/mm^2 on mutually perpendicular planes together with a shear stress of 80 N/mm^2. Find. **8**

i) Principal stress ii) Principal planes
iii) Maximum shear stress iv) Plane of maximum shear stress.

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