Seat No. | | | | | | |

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मठ - 016

Strength of Materials
(1020)

P. Pages : 4

Time : Three Hours **Max. Marks : 100**

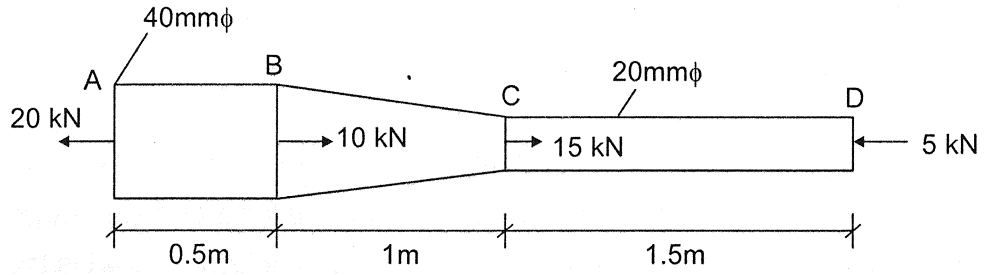
Instructions to Candidates :

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 complete question at one place only.
5. All questions are compulsory and solve **any two** bits out of a, b, c in each question.
6. Assume suitable data, if necessary.
7. Use of non programmable calcualtor is allowed.

UNIT - I

1. a) i) Define Hooke's law. **2**

ii) Find the change in length of bar ABCD subjected to axial forces as shown in fig. **8**



b) i) Define Poisson's ratio. **2**

ii) Determine the elongation of conical bar under the action of its own weight it the length of bar is 'ℓ', the diameter of the base is 'd' and the weight per unit volume of the material is ρ. **8**

c) i) What is bulk modules. **2**

ii) A steel block of 360 mm x 80 mm x 160 mm is subjected to the following forces :
i) A tensile force of 1280 kN on the 160 mm x 80 mm face
ii) A tensile force of 3456 kw on the 360 mm x 80 mm faces &
iii) A compressive force of 5184 kN on the 160 mm x 360 mm faces.
Find the changes in the dimension of the block & change in volume.

Take $E = 2 \times 10^5 \, N/mm^2$ and 1/m = 0.25. **8**

UNIT - II

2. a) i) Define principal stresses. **2**

ii) The principal stresses at a point in a bar are $200 \, N/mm^2$ (tensile) and $100 \, N/mm^2$ (compressive). Determine the resultant stresses in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. Also determine the maximum intensity of shear stress in the material at the point. **8**

b) i) Explain maximum total strain energy theory for failure of material. **2**

ii) At a point in a strained material, the bending stress is 6_b and the shear stress is τ. It the principal stresses at the point are 60 MPa tensile and 20 MPa compressive, Find the value of 6_b and τ.

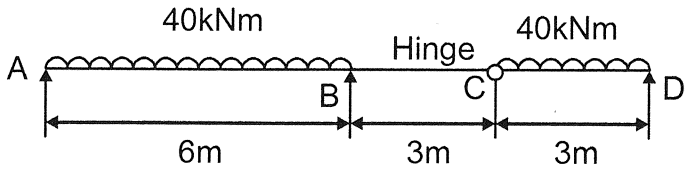
Also find the value of τ_{max}. **8**

c) An unknown weight falls through a height of 10 mm on a collar rigidly attached to the lower end of a vertical bar 500 cm long and $600 \, mm^2$ in section. It the maximum extension of the rod is to be 2mm, what is the corresponding stress and magnitude of the unknown weight ?

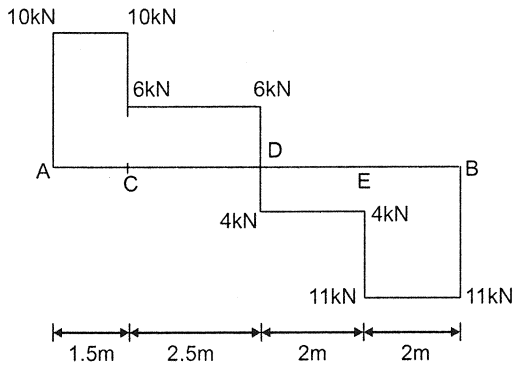
Take $E = 2.0 \times 10^5 \, N/mm^2$. **10**

UNIT - III

3. a) Draw shear force and Bending moment diagram for a beam given in the figure below. **10**



b) Draw beam loading diagram and bending moment diagram from a given shear force diagram. **10**



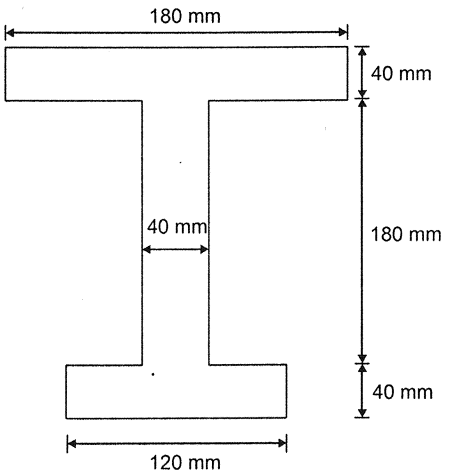
c) A beam is 10 m long and is simply supported at the ends. It carries concentrated loads of 100 kN and 60 kw at a distance of 2m and 5m respectively from the left end. Calculate the deflection under each load.

Find also maximum deflection. Take $I = 18 \times 10^8$ mm^4 and $E = 200$ kN/mm^2 **10**

UNIT - IV

4. a) A simply supported wooden beam of span 1.3 m having a cross section 150 mm wide by 250 mm deep carries a point load w at the centre. The permissible stress are 7 N/mm^2 in bending and 1 N/mm^2 in shearing. Calculate safe load w. **10**

b) A cast iron bracket subjected to bending has cross section of I - form with unequal flanges. The dimensions of the section are as follows. Find the position of neutral axis and moment of inertia of the section about the neutral axis. If the maximum bending moment on the section is 40 MN-mm, Determine the maximum bending stress. **10**



c) A 20 m high masonry chimney is 2m square at the base and tapers to 1 meter square at the top. The tapered central flue is circular in cross section and 1 meter diameter at the base. If the total weight of the brick work above the base is 1300 kN. Find for what uniform intensity of wind pressure on one face of the chimney, the stress distribution across the base just ceases to be wholly compressive. **10**

UNIT - V

5. a) Derive the relation for circular shaft when subjected to torsion.

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$ **10**

b) A cast iron pipe of 400 mm internal diameter and 100 mm thickness carries water under a pressure of $8\ N/mm^2$. Determine the maximum and minimum intensities of hoop stress across the section. Also sketch the radial pressure distribution and hoop stress distribution across the section. **10**

c) A cylindrical thin drum 800 mm in diameter and 3m long has a shell thickness of 10 mm. If the drum is subjected to an internal pressure of $2.5\ N/mm^2$, Determine :

i) The change in diameter.
ii) Change in length
iii) Change in volume.

Take $E = 2 \times 10^5\ N/mm^2$, Poisson's ratio = 1/4. **10**

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