Seat No. | | | | | | |

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मठ - 002

Strength of Materials
(123103)

P. Pages : 4

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

Instructions to Candidates :

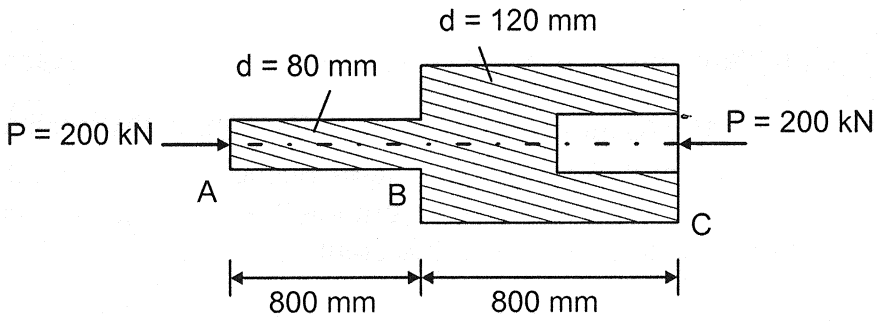
1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt **any two** sub questions from each unit.
5. Figure 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) Define Bulk modulus. **2**

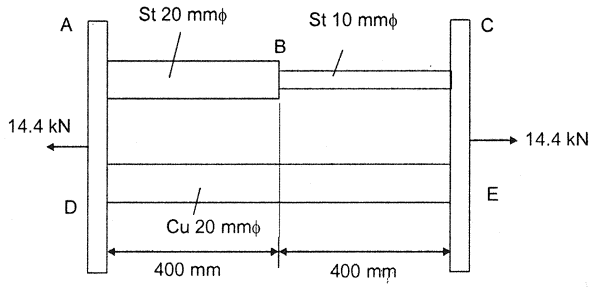
ii) Fig. shows a bar ABC made of plastic, consisting of parts AB & BC of length 800 mm each. The part AB has diameter 80 mm & part BC has diameter 120 mm with a central hole for one half of its length. The bar has to carry an axial compressive force of 200 kN. Find the maximum diameter of the hole if the shortening of the bar shall not exceed 12 mm.

Modulus of elasticity of plastic is $4000\ N/mm^2$. **6**



b) A composite member is made by connecting a steel bar & a copper rod fixed at their ends. Find the maximum value of stresses in steel & copper. When the combination is subjected to an axial pull of 14.4 kN.

$E_S = 200$ GPa & $E_C = 100$ GPa. **8**



c) i) Define modulus of rigidity. **2**

ii) A bar 30 mm diameter is subjected to a pull of 60 kN. The measured extension on a gauge length of 200 mm is 0.09 mm & calculate the Poisson's ratio and the value of three module. **6**

UNIT - II

2. a) Two planes AB & AC are right angles carry shear stress of intensity $17.5\ N/mm^2$, while there plane also carry a tensile stress of $70\ N/mm^2$ & compressive stress of $35\ N/mm^2$ resp.
Determine the principal planes & the principal stresses. Also determine the maximum shear stress & the planes on which it acts. **8**

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

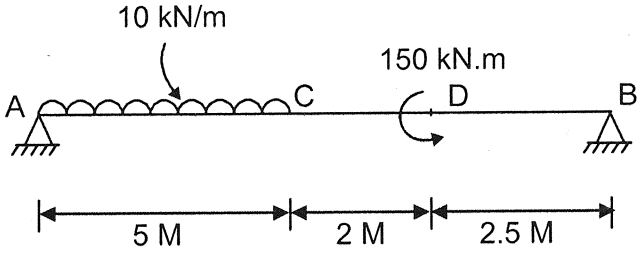
ii) The principal tensile stresses at a point in a bar are $200\ N/mm^2$ (tensile) & $100\ N/mm^2$ (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stresses. Also determine the maximum intensity of shear stress in the material at the point. **6**

c) i) Calculate the stress for suddenly applied load. **2**

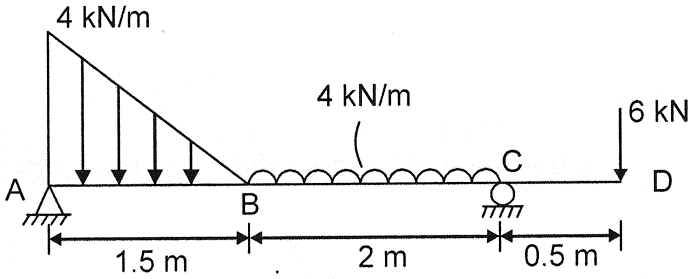
ii) A bar is 3 m long & 60 mm diameter. It is subjected to a tensile load of 200 kN. Find the stress and the elongation when the load is applied gradually. What would be maximum stress and maximum elongation if the load had been suddenly applied Take $E = 2 \times 10^5\ N/mm^2$. **6**

UNIT - III

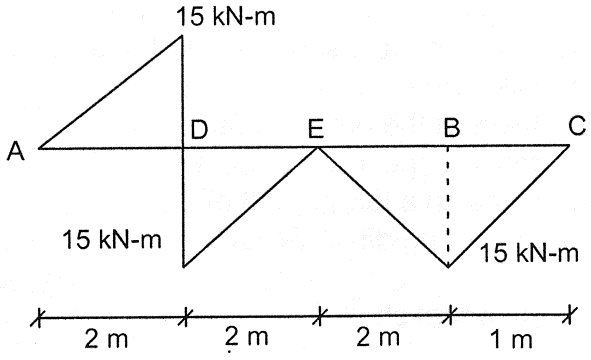
3. a) Draw shear force and bending moment diagram for the given beam as shown in fig. 8



b) Draw shear force & bending moment diagram for the beam shown in fig. Also find pt. of maximum bending moment and point of contraflexture if any. 8

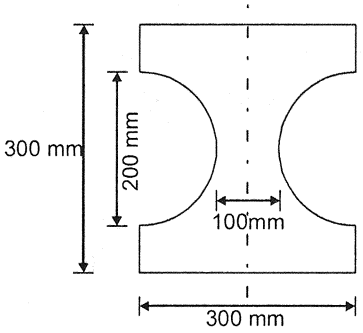


c) A beam ABC is simply supported at A & B. Support at A & B are 6 m apart and overhang BC = 1m. The bending moment diagram is shown in fig. Draw SFD & load diag. 8



UNIT - IV

4. a) A steel section is shown in fig. is subjected to shear force 200 kN.
Determine the shear stress at the important points & sketch the shear distribution diagram. **8**



b) Explain middle third rule. Solve A rectangular column of cross section 5m x 3.5 m supports a load of 200 kN at eccentricity 1.2 m & 0.75 m along longer & shorter side resp. Determine the stresses developed at all four corners. **8**

c) A masonry chimney 24 m high of uniform circular section 3.5 meters, external diameter & 2 meter internal diameter is subjected to a horizontal wind pressure of 1 kN/m^2 of projected area. Find the maximum & minimum stress intensities at the base, if the specific wt. of masonry is 22 kN/m^3. **8**

UNIT - V

5. a) Derive the equation for circular shaft when subjected to torsion $\frac{T}{J} = \frac{\tau}{R} = \frac{G\theta}{L}$. **8**

b) i) Assumptions in Theory of pure bending. **2**

ii) A shaft of hollow circular cross section has outer diameter 120 mm, inner diameter 90 mm. It is subjected to torsional moment of 18 kN-m for this shaft compute -
i) Shear stress at the outer surface.
ii) Shear stress at the inner surface.
iii) Angle of twist in a length of 3 m.
Assume modulus of rigidity = 84 GPa. **6**

c) i) Explain thin cylindrical shell. **2**

ii) A cylindrical shell of diameter 400 mm & length 1.2 m has thickness 12 mm It is filled with water with a pressure of $3 N/mm^2$. Find the additional volume of water to be pumped in the cylinder to developed required pressure. Take $E = 2 \times 10^5 N/mm^2$, 1/m =0.3 &

Bulk modulus kwater = $2100 N/mm^2$. **6**

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