* 3 6 9 7 *

Strength of Materials
(123103 / 213103)

P. Pages : 4

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

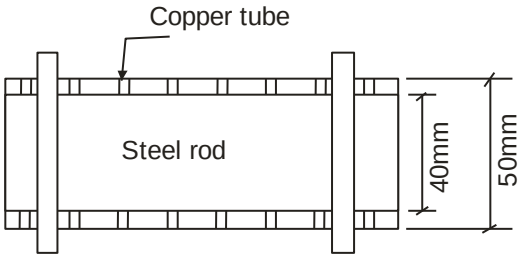
Instructions to Candidates :
1. Do not write anything on question paper except Seat No.
2. Answer sheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Attempt complete question at one place only.
5. All questions are compulsory and solve **any two** bits of a, b & c in each question.
6. Assume suitable data.

UNIT – I

1. a) Explain lateral strain, Poisson's ratio. Bulk modulus in detail also define relation between E & K. **8**

b) Three vertical rods equal in length and each 12mm in diameter are equispaced in a vertical plane together support a load of 10000N. The rods being so adjusted to share the load equally. It now an additional load of 10000N be added determine the stress in each rod. The middle rod is of copper and the outer rods are of steel. Take $E_S = 2\times10^5 N/mm^2$ & $E_C = 1\times10^5 N/mm^2$. **8**

c) A steel rod 40 mm in diameter is enclosed by a copper tube of external diameter 50 mm and internal diameter 40 mm. A pin 25 mm in diameter is fitted transverse to the assembly at each end as shown in fig. so as to secure the rod and the tube. If the temperature of the assembly is raised by 60ºC, find i) stresses in the steel rod and the copper tube. ii) The stress in the pin. Take $E_S = 2\times10^5 N/mm^2$, $E_C = 1\times10^5 N/mm^2$, $\alpha_S = 1.2\times10^{-5}$ per C & $\alpha_C = 1.6\times10^{-5}$ per C. **8**



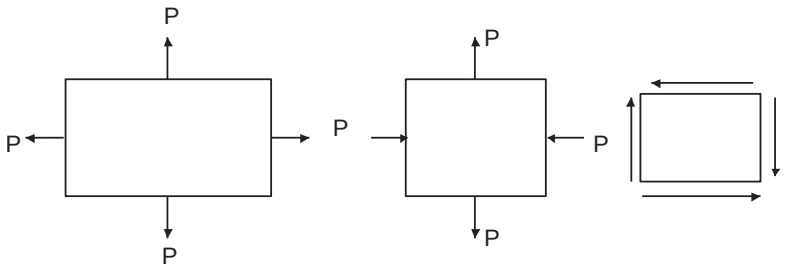
UNIT – II

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

b) A 10mm diameter mild steel bar of length 1.5 metres is stressed by a weight of 120N dropping freely through 20mm before commencing to stretch the bar. Find the maximum instantaneous stress and the elongation produced in the bar. **8**

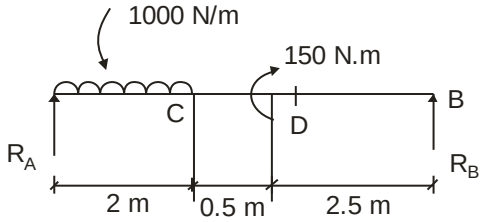
Take $E = 2 \times 10^5 \, N/mm^2$.

c) Draw respective Mohr's circle for the elements subjected to the state of stress as shown in fig. **8**

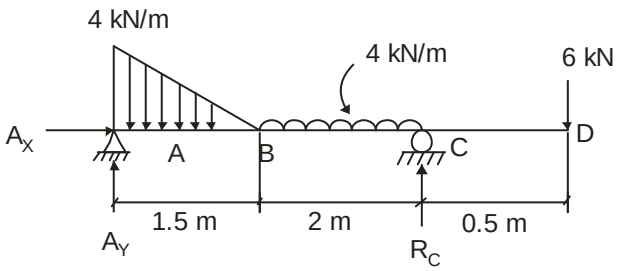


UNIT – III

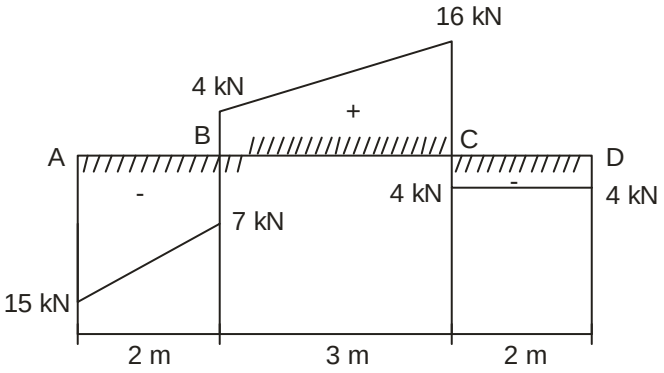
3. a) A beam 5 m long and simply supported at each end, has a uniformly distributed load of 1000 N/m. extending from the left end to a point 2m away. There is also a clockwise couple of 1500N.m applied at the centre of the beam. Draw the S.F. and B.M.D. for the beam and find the maximum bending moment. Neglect the weight of the beam. **8**



b) Draw S.F. & B.M. diagram for the beam shown in fig. Also find point of maximum BM and point of contraflexure if any. **8**



c) Fig. is a shearing force diagram for a beam which rests on two supports. One being at the left hand end. Deduce from SFD the loading on the beam. Draw the B.M.D. with principal values. **8**

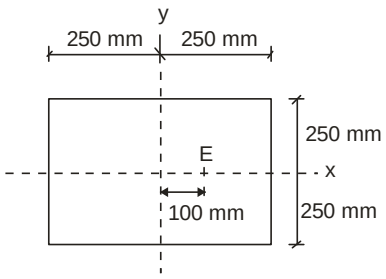


UNIT – IV

4. a) A machine component of semicircular section 200mm diameter acts as a beam of span 1.2 meter. It is placed with its base horizontal. If it carries a uniformly distributed load of 100KN/m run on a whole span. Find the maximum stress induced. **8**

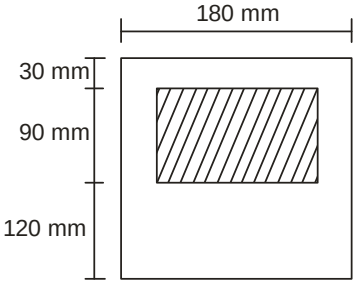
b) i) Define middle third rule. **2**

ii) A rectangular column of cross section shown in fig. carries a point load of 5000KN at point E on the cross section. Determine the minimum and maximum stresses on the section. **6**



c) A simply supported cost iron beam 2m long has the cross section as shown in fig. If the intensity of load on beam is 30 KN/m, determine the maximum compressive stress developed in beam. **8**

ρ for material = $7245\,Kg/m^3$.



UNIT – V

5. a) A thin spherical shell 1m diameter & 12mm thick is filled with water at atmospheric pressure. What intensity of pressure would be developed in the shell if 0.175 Lit of water is pumped in the shell. Also find the hoop stress induced. **8**

Take $E = 2 \times 10^5 \, N/mm^2$ & $1/m = 0.3$.

b) A solid shaft is subjected to a bending moment of 2.3 KN.m, find twisting moment of 3.45 KN.m. Find the diameter of the shaft if the permissible tensile & shear stresses for the material of the shaft are limited to $703 \, MN/m^2$ & $421.8 \, MN/m^2$ respectively. **8**

c) A hollow shaft is to have an outside diameter d and inside diameter d/2. Calculate the minimum value of d if it is to transmit 375 KW at 105 rpm with a working stress of $40 \, N/mm^2$. Determine the twist in a length to 10 times the external diameter. **8**

Take $G = 8 \times 10^4 \, N/mm^2$.

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