Seat No. | | | | | | |

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BAI1304

Strength of Materials
(New) (1010)

P. Pages : 7

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 Answer **any two** questions from each unit.
6. Use of non-programmable calculator is allowed.

UNIT - I

1. Two steel rods and one copper rod each 25 mm diameter together support a load of 30 kN as shown in fig. 1. Find the stresses in the rods $E_s = 210$ GPa $E_{cu} = 110$ GPa. **10**

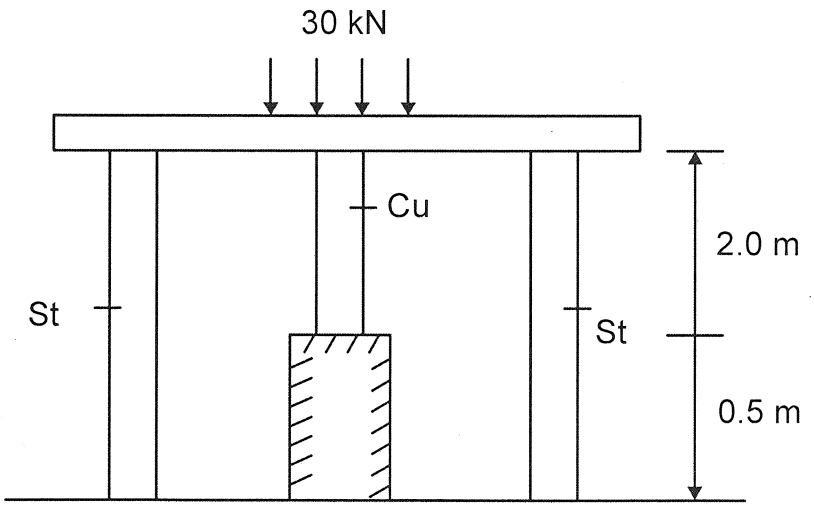

Fig. 1

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2. A steel bar 25 mm diameter, 500 mm long is co-axially enclosed in a brass tube of 30 mm internal diameter and 5 mm thickness. Both are fixed at their ends together. Composite beam is subjected to an axial pull f and the composite beam elongates by 0.12 mm. Find the stresses developed in steel rod, brass tube and the value. F. Assume for steel $E_s = 200\,kN/mm^2$ and for brass $E_b = 80\,kN/mm^2$. **10**

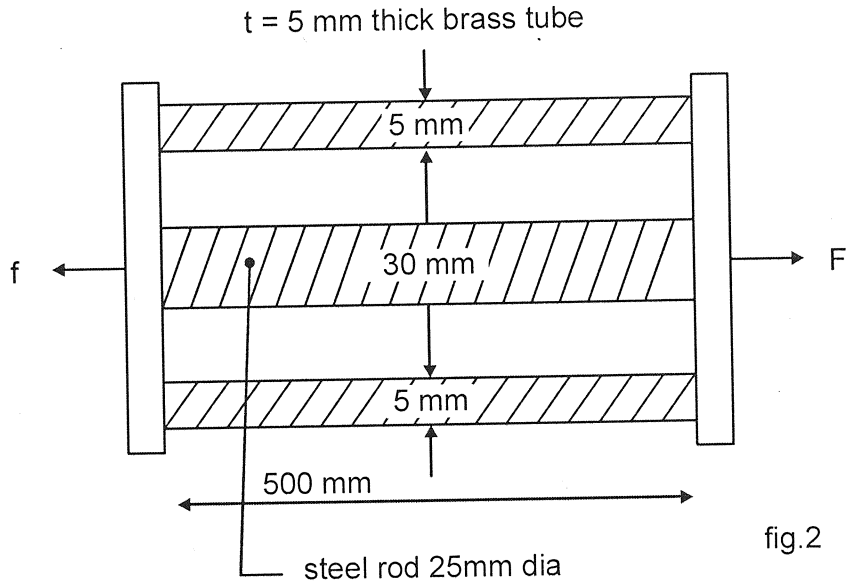

fig.2

3. A bar length ℓ has uniform thickness 't' the height of the bar varies uniformly from d_1 at the longer end to d_2 at smaller. The bar is subjected to an axial pull P Assuming young's modulus of the bar material as E. Prove that extension of the bar will be $d\ell = \frac{4P\ell}{\uparrow Ed_1 d_2}$. **10**

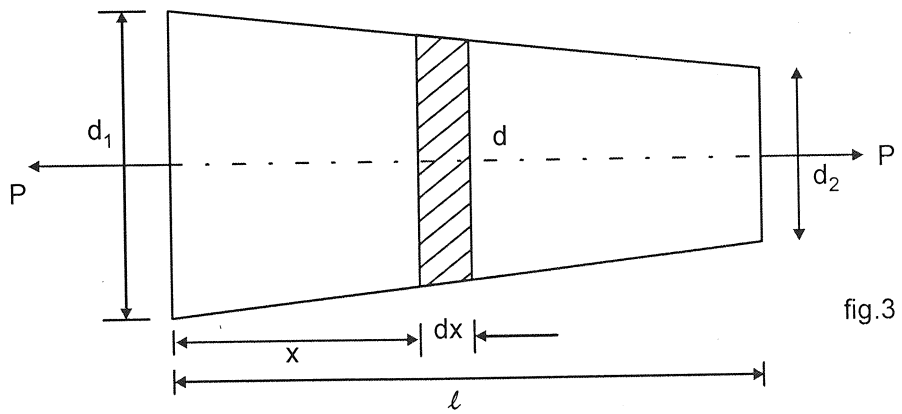

fig.3

UNIT - II

4. A uniform bar with fixed ends is axially loaded as shown in fig. 4 If $P_1 = 2000\,kN$, $P_2 = 3000\,kN$ and cross-sectional area is $4000\,mm^2$ find the reactions on fixed ends. **10**

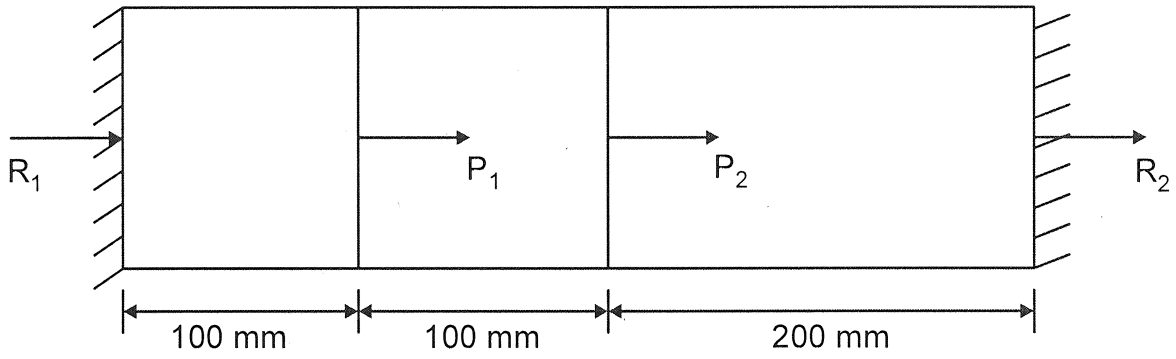

Fig. 4

5. A boiler shell 2 m diameter 5 m long to an internal. Fluid pressure of 2MPa. If maximum tensile stress allowed in steel plate is 150 MPa. Find thickness of plate. Also find the changes in diameter, length and volume of the shell. **10**

6. A member of rectangular section length 600 mm width 80 mm thickness 20 mm. cames normal stresses in the three direction as $\sigma_x = 90$ MPa. (tensile) $\sigma_y = 40\,MPa$. (compressive) and $\sigma_z = 0$. Calculate the strains in the three directions. Also calculate the change in three direction. Take poisson's ratio. 0.25. **10**

UNIT - III

7. A beam ABC simply supported at A and B support A and B are 6 m apart and overhang BC = 1 m. The Bending moment diagram for the beam is as shown. Draw SFD and load diagram. **10**

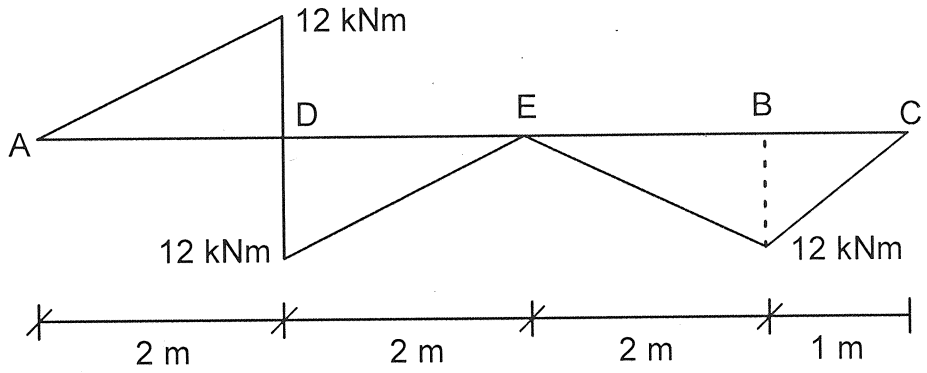

Fig. 5

8. A beam having a cross section m form of channel shown in fig. 6 subjected to bending moment acting about the xx. axis. Calculate the thickness 't' of channel in order that the bending stresses at the top and bottom of beam will be in ratio 7:3. **10**

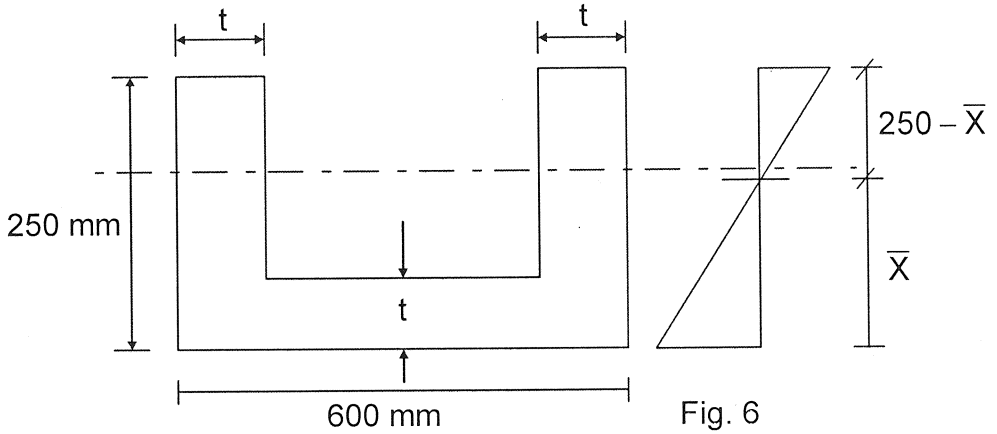

Fig. 6

9. A beam of total span 8 m shown in fig. 7 It has a hinge at A and a roller at C. Two brackets are welded at B. Draw sf and BM diagrams giving all relevent values. **10**

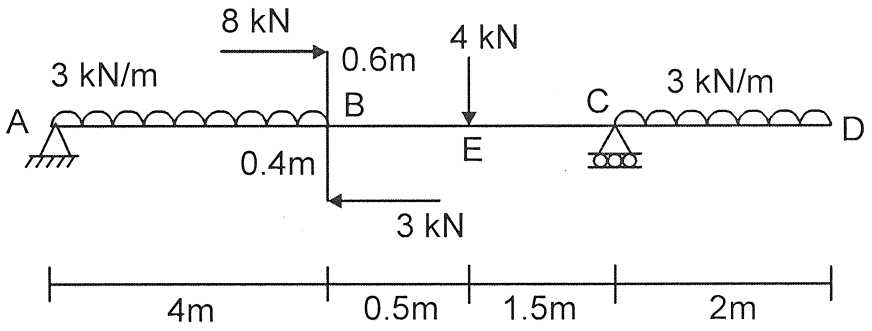

Fig. 7

UNIT - IV

10. A solid right circular cone hangs vertically as shown in fig. 8 It is subjected to its own weight-only. Determine the strain energy stored with the bar. Assume specific weight-stored with the bar. Assume specific weight of the cone as P and modulus of elasticity as E. **10**

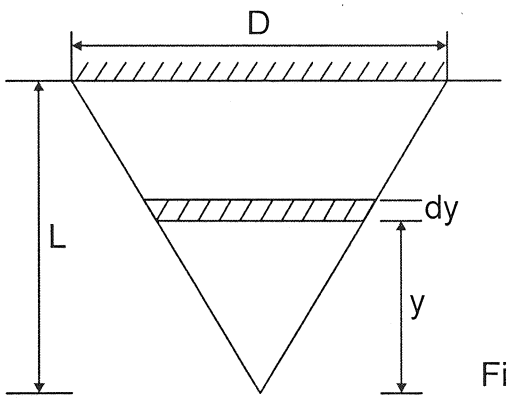

Fig. 8

11. A hollow cost iron column fixed at support carries an axial load of 1000 KN. The column is 5 m long and has an external diameter of 250 mm determine the thickness of the metal required use Rankine's formula.

Take $a = \frac{1}{6400}$ and working stress 80 MPa. **10**

12. A beam of square section is used with a diagonal position of length 100 mm. The shear force is 200 kN. Find the position and magnitude of maximum shear stress and mean shear stress also show that the stress at neutral axis is equal to mean value. **10**

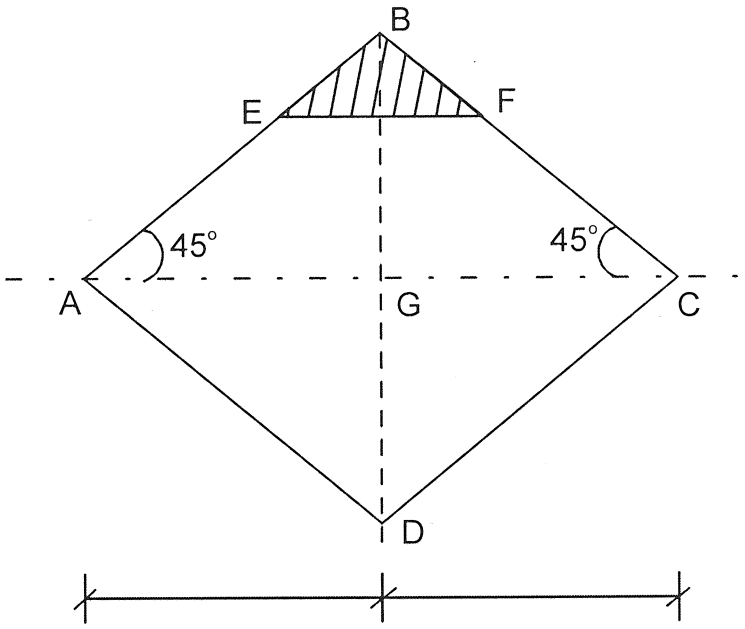

Fig. 9

UNIT - V

13. A cast iron column of 200 mm external diameter and 160 mm internal diameter is subjected to a compressive load of 60 kN. The load acts at 40 mm from the axis. Determine the limiting values of stresses. **10**

14. a) What is middle third rule ? and prove. **5**

b) 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 point distance 10 cm from its axis. Determine the maximum tensile and compressive stresses. **5**

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15. At a point in a strained material the normal stresses acting are + 50 MPa and – 30 MPa at a plane right angle to each other with a shear stress of 20 MPa. **10**
Determine.

i) Principal stresses and their nature.

ii) Direction of principal stresses.

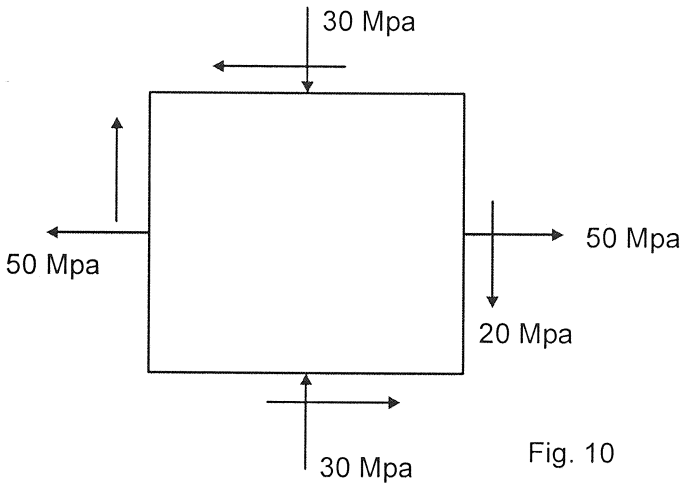

Fig. 10

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