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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, November 2014
(2013 Scheme)
13.304 : MECHANICS OF SOLIDS
(MNPSU)

Time : 3 Hours Max. Marks : 100

PART – A

Answer **all** questions. **Each** question carries **4** marks.

1. State Saint Venant's principle.
2. Define thermal stress and derive an expression for the stress developed in a bar restrained at both ends subjected to an increase in temperature.
3. Explain principal stresses and principal planes.
4. What are the assumptions made in simple theory of bending ?
5. Write down the torsional formula and explain the terms. **(5×4=20 Marks)**

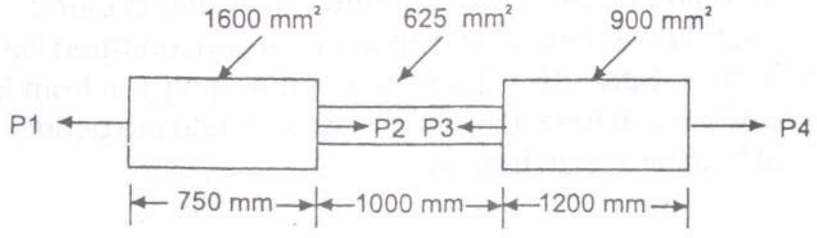
PART – B

Answer **one** full question from **each** Module. **Each** question carries **20** marks.

Module – I

6. a) Explain the principle of superposition to evaluate total strain of axially loaded bars. **5**

   b) A brass bar ABCD is subjected to point loads P_1, P_2, P_3 and P_4 as shown in. Calculate the force P_3 necessary for equilibrium if P_1 = 120 kN, P_2 = 220 kN and P_4 = 160 kN. Determine also the net change in length of the member.



OR

P.T.O.

7. A rigid cross bar is supported horizontally by two vertical bars, A and B of equal lengths and hanging from their tops. The bars A and B are 0.6 m apart. The cross bars stays horizontal even after a vertical force of 6 kN is applied to it at a point 0.4 from B. If the stress in A is 200 MPa, find the stress in B and the area of cross section of the two rods. $E_A = 200$ GPa, $E_B = 130$ GPa. **20**

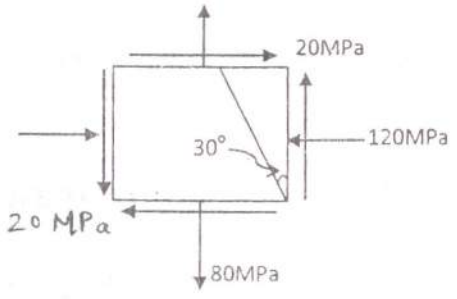
Module – II

8. a) List and define the elastic constants and derive the relation among them. **10**

   b) When a copper wire of 40 mm diameter is subjected to an axial pull of 80 kN, it reduces its diameter by 0.00775 mm. The modulus of rigidity for the wire is 0.4×10^5 N/mm^2. Calculate the Poisson's ratio and modulus of elasticity for the material. **10**

OR

9. Determine the principal stresses and principal planes in an element subjected to stresses as shown in. Also calculate
   i) Maximum shear stress and its plane
   ii) Stress conditions in the plane shown. **20**



Module – III

10. A simply supported overhanging beam ABC supported at A and B carries a uniformly distributed load of 2 kN/m for the whole span and a concentrated load of 5 kN at one third span from A. Span AB is 6 m and overhanging 1 m from B. Draw the bending moment and shear force diagram. Also calculate the bending moment and shear force at two third span from A. **20**

OR

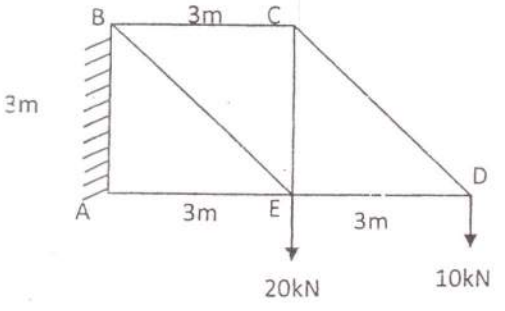
11. a) A cast iron beam of I-section is simply supported over a span of 6 m. The section consists of a top flange of 80 mm × 20 mm and web 220 mm × 30 mm size. If the allowable stress in tension and compression are 50 MPa and 150 MPa respectively, find the safe concentrated load at the centre of the beam. What are the extreme fibre stresses ? **10**

b) Briefly explain Macaulay's method to find the deflection of a simply supported beam subjected to point load. **10**

Module – IV

12. a) Determine the diameter of the hollow shaft which will transmit 100 kW at 200 rpm if the shear stress is limited to 60 MPa. Take diameter ratio 0.6. **10**

b) Analyse the truss given below by the method of joints. **10**



OR

13. a) Explain the assumptions made in Euler's column theory and derive the expression for critical load for a slender column with both ends fixed. **10**

b) A steel rod 5 m long and of 5 cm diameter is used as a column with both ends fixed. Determine the crippling load. Take E = 200 GPa. **10**