Seat No. | | | | | | |

* 2 1 8 4 *

मजल - 017

Strength of Materials
(1010)

P. Pages : 3

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** bit out of a, b & c in each question.
6. Assume suitable data if required.
7. Use of non-programmable calculator is allowed.

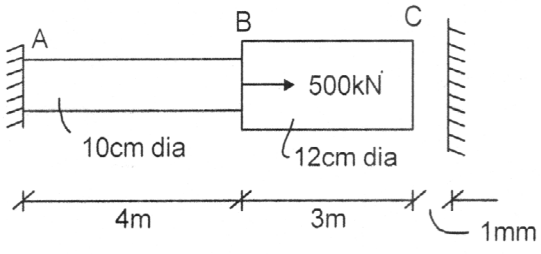
UNIT - I

1. a) Define temperature stress and lateral strain. Also find the difference between the greatest and least length of rod of regular hexagonal section of side 15mm and 600mm long which is subjected to axial force alternating between 20 kN compressive to 18 kN tensile. Take E = 200 GPa. **10**

b) Explain axial force diagram and solve a weight of 15000 N is supported by three wires in the same vertical plane. The middle wire is not steel and other two are of brass. The cross section area of each wire is 250 sq.mm. The wires are so adjusted that each wire carries equal part of load at 20°C.

Find the stresses in each wire at 70°C when $E_S = 200\,GPa$, $E_b = 100\,GPa$ and $\alpha_S = 12 \times 10^{-6}/°C$ and $\alpha_b = 19 \times 10^{-6}$ per °C. **10**

c) Define modulus of elasticity and poission's ratio. Also find the reactions at supports and stresses in part AB and BC. Take E = 200 kN/mm^2.
The member is as shown in figure. **10**



मजल - 017

UNIT - II

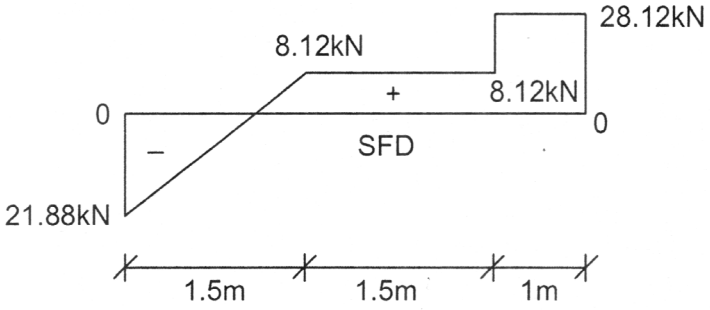
2. a) Derive the equation for stress set up in spherical shell. Also find modulus of elasticity and bulk modulus if in testing of metallic rod it is observed that the diameter of rod is reduced by 0.0025 mm under axial pull of 20 kN. The original diameter of rod is 15mm. The modulus of rigidity of rod material is 50 kN/mm^2. **10**

b) Derive the equation of strain energy and stress produced due to suddenly applied load. Also determine the increase in volume of thin cylindrical shell of diameter 1.5 m and length 3.0m containing fluid at pressure 2.5 N/mm^2. The thickness of shell is 10mm. Take E=200 GPa and poisson's ratio $\mu = 0.3$. **10**

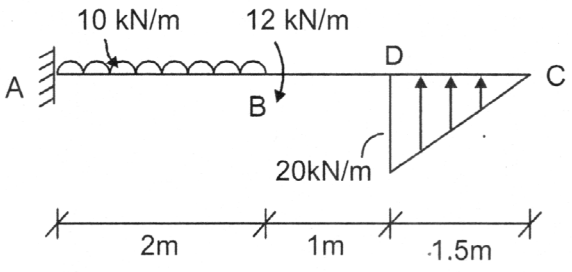
c) Explain complimentary shear stresses. Also calculate instantaneous stress and elongation of rope if a wagon of 3 kN is attached to wire rope and moving on level track at speed of 5 km/hr. The cross section area of rope is 5000 mm^2 and length 10m. Suddenly the rope jams and wagon is brought to rest. **10**

UNIT - III

3. a) On a beam there is applied clockwise moment of 30kN.m at centre. The shear force diagram is as shown develop the beam loading and also draw bending moment diagram. **10**



b) State the equation of bending with specifying each term. Also draw the shear force & bending moment diagram for a given beam. **10**



c) Derive the relation between rate of loading, shear force and bending moment. Also find the stresses at extreme fibre of T-section formed from two wooden planks 150 x 40mm each. A moment of 3.5 kN.m is applied around the horizontal neutral axis, inducing tension below neutral axis. **10**

UNIT - IV

4. a) State limitation of Euler's formula in long column. Also sketch the shear stress distribution with its value across the section. The section is I-section with 200mm width and 340mm overall depth, having web thickness 10mm and flange thickness 20mm. It carries shear force of 105 kN. **10**

b) State the assumptions in theory of torsion. Also determine the safe diameter of column to carry load of 250 kN with factor of safety 5. A column is hollow cylindrical cast iron column of 4m length with both ends fixed. Take the internal diameter 0.8 times external diameter and $\sigma_c = 550\,MPa$ and $a = \frac{1}{1600}$ in Rankine formula. **10**

c) State the equation of shear stress specifying each term. Also find the external and internal diameter assuming that maximum torque is 1.3 times the mean. A shaft has to transmit 300 kw at 80 rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 times the external diameter. **10**

UNIT - V

5. a) Define resultant stress and angle of obliquity. Also find the maximum height of wall so that there is no tension at base. A long rectangular wall is 2.5 m wide and subjected to maximum wind pressure 1.1 kN/m^2. The specific weight of masonry is 22 kN/m^3. **10**

b) Define direct stress and bending stress. Also solve. The stresses at point in strained material are 120 MPa tensile and 90 MPa compressive on planes right angles to one another. If the maximum principal stress is not to exceed 150 MPa in tension, to what shearing stress can the material be subjected on these planes. What is the maximum shear stress in the material.
Also find the magnitude of another principal stress and its inclination to 120 MPa stress. **10**

c) State the failure theories and explain maximum principal stress theory.
And solve. A hollow shaft is subjected to torque of 40 kN.m and bending moment of 50 kN.m. The internal diameter is 2/3 of the external diameter. If maximum shear stress is not to exceed 80 Mpa. Find the diameter of shaft. **10**

****