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Reg. No. : .....

Name : .....

Third Semester B.Tech. Degree Examination, December 2012
(2008 Scheme)
Branch : Civil
08.302 : MECHANICS OF STRUCTURES

Time : 3 Hours Max. Marks : 100

Instruction : *Answer **all** questions from Part **A** and **one** question in **full** from **each** Module in Part **B**.*

PART – A

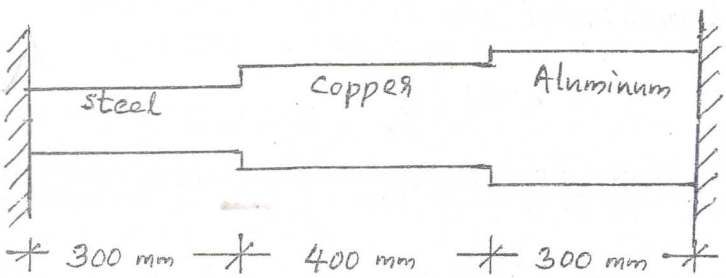
1. What is the maximum possible value of Poisson's ratio for an ordinary material ? Justify your answer.
2. A steel bar of circular cross section having 12 mm diameter is embedded in a concrete block for a length of 300 mm. If a tensile force of 15 kN is applied to the bar, find the average shear stress developed between steel and concrete.
3. What is meant by principal stress ? Explain briefly.
4. Explain the relation between bending moment, shear force and intensity of loading at any section of a beam with the help of a suitable example.
5. What do you mean by 'beam of uniform strength' ?
6. Show that the strain energy density due to normal stress is $\frac{\sigma^2}{2E}$, where σ is the stress and E is the modulus of elasticity of the material.
7. Locate the kern of section of a rectangular cross section 300 mm × 450 mm.
8. Explain the principle of wire wound cylinders. **(8×5=40 Marks)**

P.T.O.

PART – B

(Module – I)

9. a) A stepped bar made of steel, copper and aluminum is held between two unyielding supports as shown. The cross sectional areas of the bars are 200 mm^2, 350 mm^2 and 500 mm^2 respectively. Find the stresses induced in each bar, if the temperature is increased by 40°C. Find the reaction at the supports also. The modulii of elasticity of steel, copper and aluminum are 200 GPa, 110 Gpa and 70 GPa respectively. The coefficients of thermal expansion of these materials are 12×10^{-6}/°C, 16×10^{-6}/°C and 23×10^{-6}/°C respectively. **14**



b) The volume of a bar was found to increase by 0.03% under a uniaxial tensile stress of 140 N/mm^2. Find the Poisson's ratio of the material if its modulus of elasticity is 2.1×10^5 N/mm^2. **6**

10. At a point in a strained body the normal and shear stresses on a particular plane (plane A) are 140 N/mm^2 (tensile) and 25 N/mm^2 (clockwise) respectively. On another plane (plane B) the normal and shear stresses are respectively 20 N/mm^2 (compressive) and 50 N/mm^2 (clockwise). Find the following :

i) Principal stresses and inclination of principal planes with respect to plane A.

ii) Maximum shear stress and the inclination of the plane carrying it with respect to plane A.

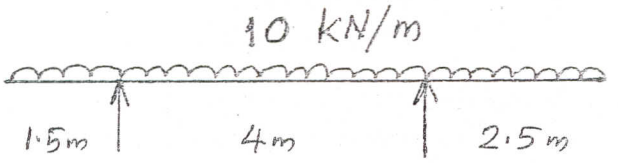
iii) Angle between planes A and B.

iv) Inclination of the plane of maximum obliquity (with respect to plane A).

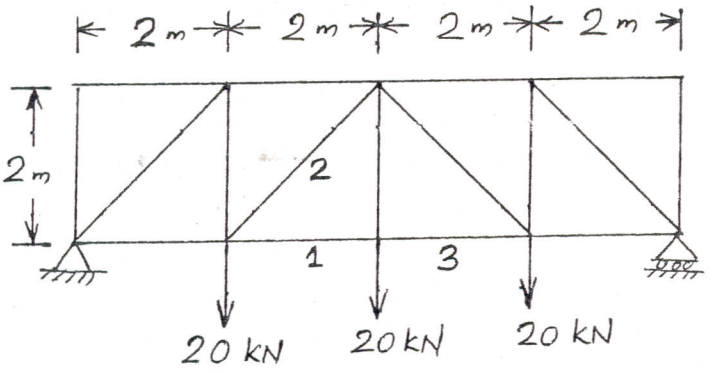
Use Mohr's circle method. **20**

Module – II

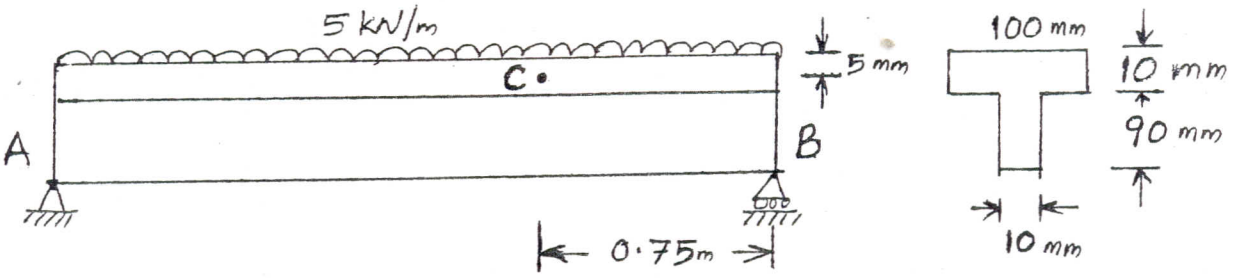
11. a) Draw the bending moment and shear force diagrams of the overhanging beam shown. Find the maximum bending moment and mark its location. 10



b) Find the forces in the members 1, 2 and 3 of the truss shown using method of sections. 10



12. A simply supported beam having a T-shaped cross section has a span of 2 m and carries a uniformly distributed load of 5 kN/m. Find the normal and shear stress at a point C marked in the figure. Also find the maximum bending stress and shear stress in the beam and indicate their locations. 20



Module – III

13. a) A masonry retaining wall 6 m height is trapezoidal in section, 1 m wide at the top and 3 m at the base, with one side vertical. If the lateral pressure exerted by the retained material on the vertical face varies from zero at the top to 22 kN/m^2 at the base, calculate the maximum and minimum stresses induced at the base. Also sketch the stress distribution. Unit weight of masonry is 21 kN/m^3. **12**

b) A vertical steel standpipe of inside diameter 3 m and wall thickness 10 mm is used to store water. What height of water will produce a maximum circumferential stress of 20 N/mm^2 in the wall of the pipe ? **8**

14. a) A solid shaft of diameter D has to be replaced by a hollow shaft of the same material, same length and same weight. External diameter of the hollow shaft is D_0 and the ratio of the internal diameter to external diameter is r show that, if the maximum shear stress remains the same, the ratio of torsional strength of hollow shaft to that of solid shaft is $\frac{D_0}{D}(1+r^2)$. Also show that, for a given angle of twist, the ratio of torsional strength of hollow shaft to that of solid shaft is $\frac{1+r^2}{1-r^2}$. **14**

b) A load of 500 N is dropped on to a vertical bar 600 mm long and 20 mm diameter. Find the height of drop, if the maximum instantaneous stress produced is 180 N/mm^2. Modulus of elasticity of the material is 200 GPa. **6**