Reg. No. : | | | | | | | | | | |

Question Paper Code: 31014

B.E. / B.Tech. DEGREE EXAMINATION, OCTOBER 2014.

Third Semester

Civil Engineering

01UCE304 - MECHANICS OF SOLIDS - I

(Regulation 2013)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions.

PART A - (10 x 2 = 20 Marks)

1. Define stress.
2. State Hooke's law.
3. What is mean by perfect frame?
4. Define Centre of Gravity.
5. Define shear force and bending moment.
6. Write the theory of simple bending equation.
7. Define Torsion.
8. What are the various types of springs?
9. Define principle stresses and principle plane.
10. What is the use of Mohr's circle?

PART - B (5 x 16 = 80 Marks)

11. (a) Determine the value of Young's modulus and Poisson's ratio of a metallic bar of length 30 cm, breadth 4 cm and depth 4 cm when the bar is subjected to an axial compressive load of 400 kN. The decrease in length is given as 0.075 cm and increase in breadth is given as 0.03 cm. (16)

Or

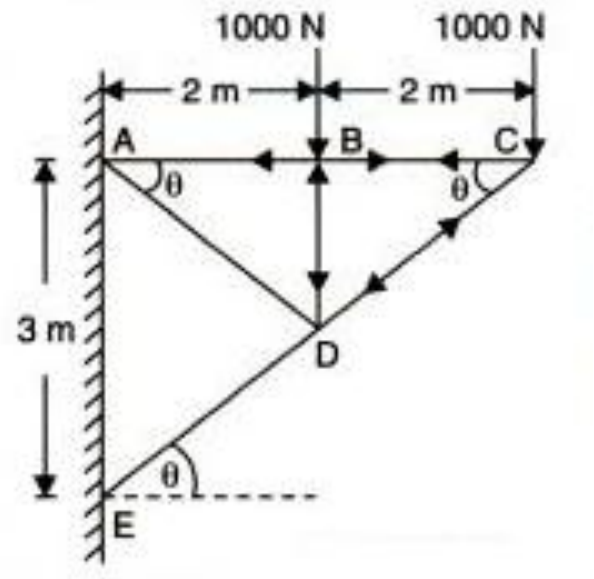
(b) A steel rod of 3 cm diameter is enclosed centrally in a hollow copper tube of external diameter 5 cm and internal diameter of 4 cm. The composite bar is then subjected to an axial pull of 45000 N. If the length of each bar is equal to 15 cm, determine:

(i) The stress in the rod and tube and

(ii) Load carried by each bar.

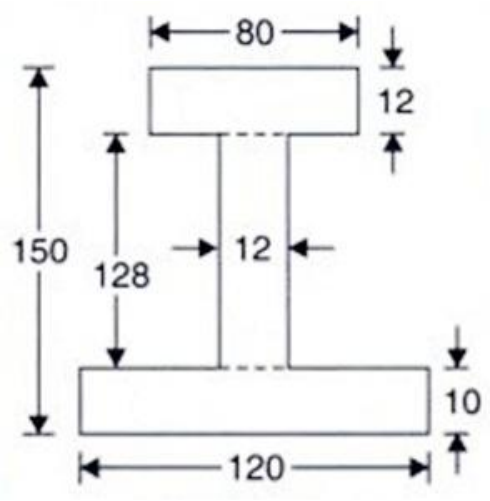
Take E for steel = 2.1×10^5 N/mm^2 and for copper = 1.1×10^5 N/mm^2. (16)

12. (a) Determine the forces in all the members of a cantilever truss shown in fig. (16)



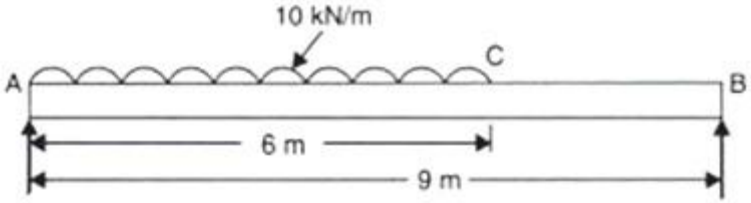
Or

(b) Determine the moment of inertia of I section shown in fig. (16)



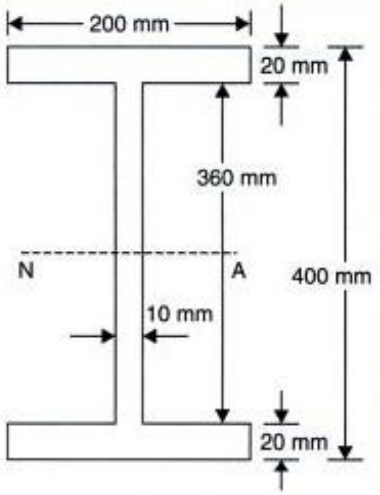
All dimension are in 'mm'

13. (a) Draw the shear force and bending moment diagram for a simply supported beam of length 9 m carrying an udl of 10 kN/m for a distance of 6 m from left end. Also calculate the maximum B.M. on the section. (16)



Or

(b) A rolled steel joist of I section has the dimensions as shown in figure given below. This beam of I section carries an udl of 40 kN/m run on a span of 10 m, calculate the maximum stress produced due to bending. (16)



14. (a) A hollow shaft is subjected to a torque of 40 kNm and a bending moment of 30 kNm. The internal diameter of the shaft is one half the external diameters. If the maximum shear stress is not to exceed 80 MN/m^2, find the diameter of the shaft. (16)

Or

(b) A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils with the mean diameter of 100 mm. The spring is subjected to an axial load of 100 N. Calculate:

(i) The maximum shear stress induced
(ii) The deflection
(iii) Stiffness of the spring.

Take rigidity modulus $C = 8.16 \times 10^4$ N/mm^2 . (16)

15. (a) The principal tensile stresses at a point across two mutually perpendicular planes are 120 N/mm^2 and 60 N/mm^2. Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor principal stress. (16)

Or

(b) A rectangular block of material is subjected to a tensile stress of 110 N/mm^2 on one plane and a tensile stress of 47 N/mm^2 on the plane at right angles to the former. Each of the above stresses is accompanied by a shear stress of 63 N/mm^2 and that associated with the former tensile stress tends to rotate the block anticlockwise. Find

(i) The direction and magnitude of each of the principal stress and
(ii) Magnitude of the greatest shear stress. (16)

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