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

Question Paper Code : 31196

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2013.

Third Semester

Civil Engineering

CE 2201/CE 34/CE 1202 A/10111 CE 304/080100010 — MECHANICS OF SOLIDS

(Regulation 2008/2010)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is meant by limit of proportionality and shear modulus?

2. Define principal stresses and principal planes.

3. A thin cylindrical shell has an internal dia of 250 mm and thickness of 6 mm. It is subjected to an internal pressure of 3 MN/m^2. Estimate the circumferential and longitudinal stresses if the ends of the cylinder are closed.

4. What is meant by perfect frame and deficient frame?

5. What are the assumptions made in the theory of simple bending?

6. A steel wire of 10 mm diameter is bent into a circular arc of 20 metre radius. Determine the maximum stress induced in it. Take $E = 2 \times 10^5$ N/mm^2.

7. What is the equation for maximum deflection at free end of a cantilever beam of span L, with an Udl load of w per meter length?

8. What is meant by conjugate beam and how to determine the slope and deflection of real beam from conjugate beam?

9. A solid shaft of 80 mm diameter is transmitting 100 kW power at 200 rpm. Calculate the maximum shear stress induced in the shaft.

10. What is meant by resilience of a helical spring and stiffness of a spring?

PART B — (5 × 16 = 80 marks)

11. (a) A steel rod of cross-sectional area 2000 mm^2 and two brass rods each of cross-sectional area of 1200 mm^2 together support a load of 60 kN as in fig. (i). Find the stresses in the rods. Take E for steel = 2×10^5 N/mm^2 and E for brass = 1×10^5 N/mm^2. (16)

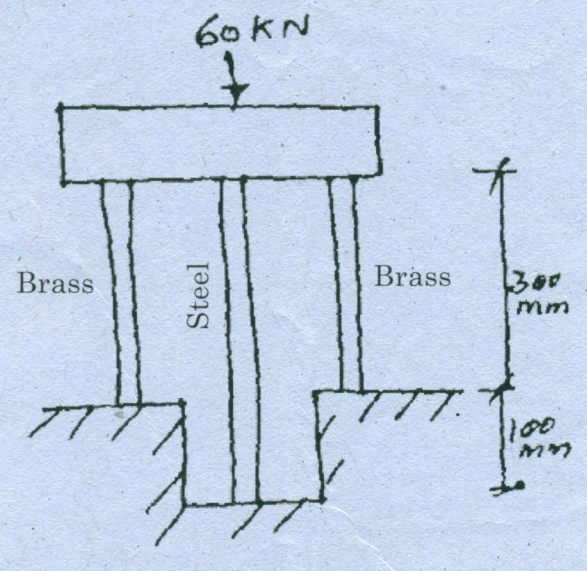

Fig. (i)

Or

(b) A bar of 25 mm diameter is subjected to a pull of 40 kN. The measured extension on gauge length of 200 mm is 0.085 mm and the change in diameter is 0.003 mm. Calculate the Poisson's ratio and the values of the three moduli. (16)

12. (a) A truss with a span of 5 m is carrying a load of 5 kN at its apex as shown in fig. (ii). Find the forces in all the members by method of joints. (16)

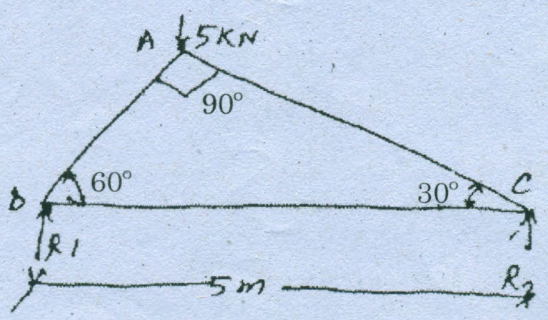

Fig. (ii)

Or

(b) A cylindrical air drum is 2.25 m in diameter with plates 1.2 cm thick. The efficiencies of the longitudinal and circumferential joints are respectively 75% and 40%. If the tensile stress in the plating is to be limited to 120 MN/m^2 find the maximum safe air pressure.

13. (a) Draw the B.M and S.F diagrams for the overhanging beam shown in fig. (iii).

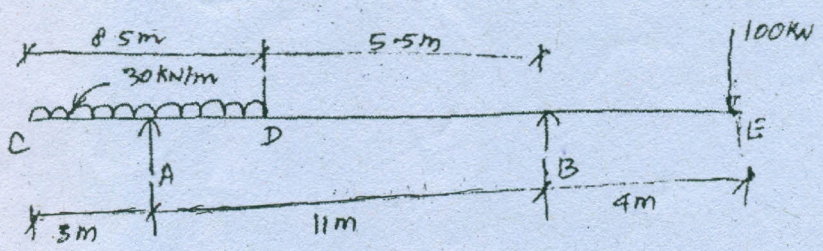

Fig. (iii)

Or

(b) A cast iron water main 12 metres long, of 500 mm inside diameter and 25 mm wall thickness runs full of water and is supported at its ends. Calculate the maximum stress in the metal if density of cast iron is 7200 kg/m^3 and that of water is 1000 kg/m^3.

14. (a) A cantilever of 3 m length and of uniform rectangular cross section 150 mm wide and 300 mm deep is loaded with a 30 kN load at the free end. In addition to this it carries a uniformly distributed load of 20 kN/m run over its entire length as in fig. (iv).

Take E = 210 GN/m^2.

Calculate :

(i) The maximum slope and maximum deflection (8)

(ii) The slope and deflection at 2 m from the fixed end. (8)

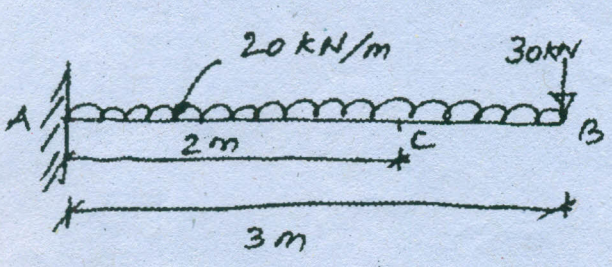

Fig. (iv)

Or

(b) A timber beam 150 mm × 250 mm in cross-section is simply supported at its ends and has a span of 3.5 m. The maximum safe allowable stress in bending is 7500 kN/m^2. Find the maximum safe U.D.L. which the beam can carry. What is the maximum shear stress in the beam for the U.D.L. calculated? (16)

15. (a) A solid circular shaft transmits 75 kW power at 200 rpm. Calculate the shaft diameter, if the twist in the shaft is not to exceed 1° in 2 meters length of shaft, and shear stress is limited to 50 MN/m^2. Take C = 100 GN/m^2. (16)

Or

(b) A closed-coiled helical spring is made out of 10 mm diameter steel rod. The coil consists of 10 complete turns with a mean diameter of 120 mm. The spring carries an axial pull of 200 N. Find the maximum shear stress induced in the section of the rod. If C = 80 GN/m^2, find the deflection in the spring, the stiffness and strain energy stored in the spring. (16)
