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

R 3157

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2007.

Third Semester

(Regulation 2004)

Civil Engineering

CE 1201 — MECHANICS OF SOLIDS

(Common to B.E. (Part-Time) Second Semester Regulation 2005)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. Express the relationship among the three elastic constants.

2. In a Mohr's circle of stresses, what represents the maximum shear stress?

3. What are the two types of trusses with respect to their joints?

4. How to increase the strength of a thin cylinder?

5. What are guided supports?

6. Draw the shear force and bending moment diagrams for the beam shown in fig. 1.

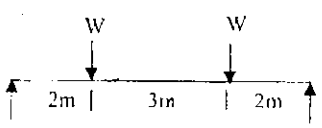

Fig. 1. (Qn. 6)

7. What is a conjugate beam?

8. Draw the variation of shear stress for a Tee section.

9. How does the shear stress vary across a solid shaft?

10. What are leaf springs?

PART B — (5 × 16 = 80 marks)

11. (a) A steel flat 24 mm × 6 mm in section riveted between two aluminium flats of same size at a temperature of 288 K is shown in fig. 2. If this assembly is subjected to a compressive force of 35 kN, find the stresses developed in each material. To what temperature the assembly can be rised that the stresses in the materials due to the load are nullified. $E_s = E_{A1} = 210$ GPa. $\alpha_s = 12 \times 10^{-6}$/K and $\alpha_{Al} = 23 \times 10^{-6}$/K.

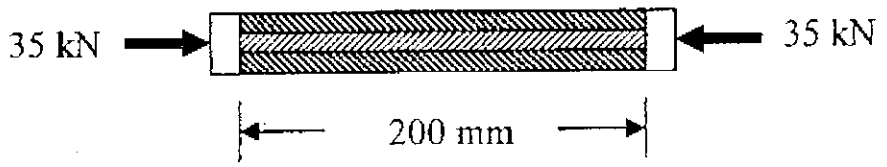

Fig. 2. (Qn. 11(a))

Or

(b) A M.S Bar of 50 mm square in size and 150 mm long is subjected to an axial thrust of 200 kN. Half the lateral strain is prevented by the application of uniform external pressure of certain intensity. If $E = 200$ GPa and Poisson's ratio 0.3, calculate the change in the length of the bar.

12. (a) Find the forces in the members of the truss shown in fig. 3.

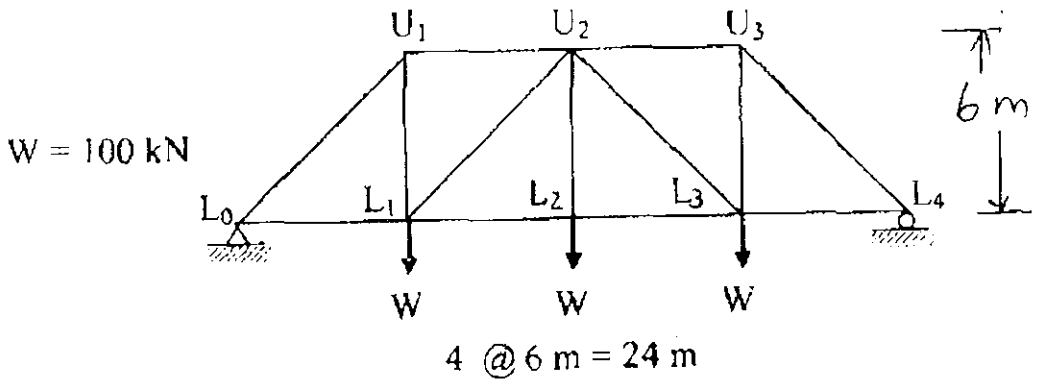

Fig. 3. (Qn. 12(a))

Or

(b) A steel cylinder with flat ends is 2m long and 1m diameter with metal thickness 10 mm. It is filled with water at atmospheric pressure. The pressure has been increased to 2 MPa by pumping more water. An amount of 2.9×10^6 mm^3 of water has been collected at the outlet after releasing the pressure. If $E = 2 \times 10^5$ MPa and Poison's ratio 0.3, find out the bulk modulus.

13. (a) A beam of uniform section 10 m long carries a UDL of 10 kN/m for the entire length and a concentrated load of 10 kN at the right end. The beam is freely supported at the left end. Find the position of the second support so that the maximum bending moment in the beam is as minimum as possible. Also compute the maximum bending moment.

Or

(b) Two wooden planks 50 mm × 150 mm in section is used to form a Tee section as shown in fig. 4. If a bending moment of 3400 Nm is applied with respect to the neutral axis, find the extreme fibre stresses and the total tensile force.

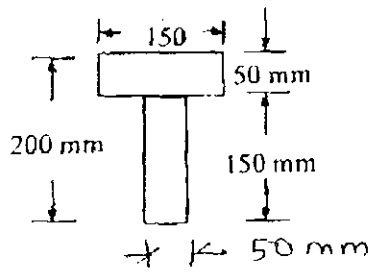

Fig. 4. (Qn. 13 (b))

14. (a) Obtain the deflection under the greater load for the beam shown in fig. 5 using the conjugate beam method.

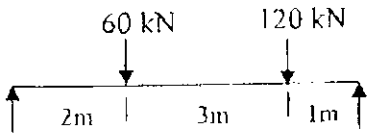

Fig. 5. (Qn. 14 (a))

Or

(b) Three planks of each 50 × 200 mm timber are built up to a symmetrical I section for a beam. The maximum shear force over the beam is 4 kN. Propose an alternate rectangular section of the same material so that the maximum shear stress developed is same in both sections. Assume the width of the section to be 2/3 of the depth.

15. (a) A steel shaft ABCD having a total length of 2400 mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80 mm and 50 mm respectively, BC is solid and 80 mm diameter. CD is also solid and 70 mm in diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 MPa and shear modulus 0.82×10^5 MPa.

Or

(b) It is required to design a close coiled helical spring which shall deflect 1 mm under an axial load of 100 N at a shear stress of 90 MPa. The spring is to be made of round wire having shear modulus of 0.8×10^5 MPa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire.