B.E. DEGREE ARREAR EXAMINATION, APRIL/MAY 2014

III SEMESTER

CIVIL ENGINEERING

CE 271 – MECHANICS OF SOLIDS {Regulations 2004}/

CE 9201 – STRENGTH OF MATERIALS – I {Regulations 2008}

(Common to Agricultural and Irrigation Engineering)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART – A (10 x 2 = 20 marks)

1. How do you analyze a composite bar made of two different materials?
2. Draw the Mohr's circle for the state of pure shear in a strained body and mark all salient points in it.
3. Distinguish between perfect and imperfect frames.
4. What are the limitations of applying method of sections for analyzing a pin-jointed truss?
5. What do you mean by shear force and bending moment?
6. Define the term "moment of resistance".
7. State any four assumptions made in theory of torsion.
8. How are springs classified?
9. What are the advantages of Macaulay's method over double integration method?
10. Define: Conjugate beam.

PART – B (5 x 16 = 80 marks)

11. A circular shaft is required to transmit a power of 220 kW at 200 rpm. The maximum torque may be 1.5 times the mean torque and the shear stress in the shaft not to exceed 50 N/mm^2. Determine the diameter required if (i) the shaft is solid (ii) the shaft is hollow with external diameter twice the internal diameter. Take modulus of rigidity = 80 kN/mm^2.

12. (a) A composite bar is made with a copper flat of size 60 mm × 40 mm and a steel flat of 60 mm × 45 mm of length 600 mm each placed one over the other. Find the stress induced in the material, when the composite bar is subjected to an increase in temperature of 120° C. Take coefficient of thermal expansion of steel as 12×10^{-6} / °C and that of copper as 18×10^{-6} / °C, modulus of elasticity of steel as 200 GPa and modulus of elasticity of copper as 100 GPa.

(Or)

(b) A thin cylindrical shell, 2 m long has 800 mm internal diameter and 10 mm thickness. If the shell is subjected to an internal pressure of 1.5 MPa, find (i) the hoop and longitudinal stresses developed, (ii) maximum shear stress induced and (ii) the changes in diameter, length and volume. Take modulus of elasticity of the wall material as 205 GPa and Poisson's ratio as 0.3.

13. (a) Analyze the simply supported truss shown in Fig. Q.13(a) by method of joints.

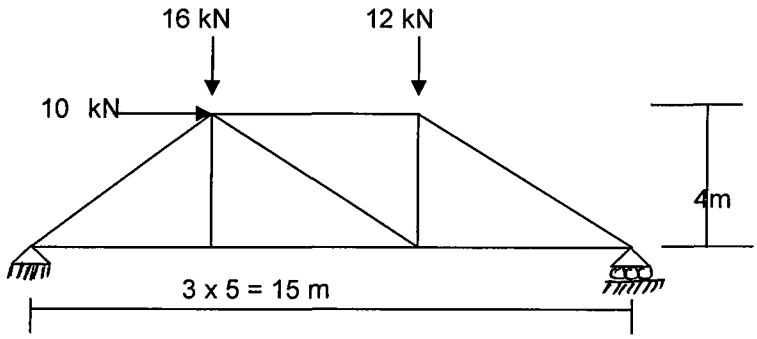

Fig. Q.13(a)

(Or)

(b) Analyze the cantilevered truss shown in Fig. Q.13(b) by method of sections.

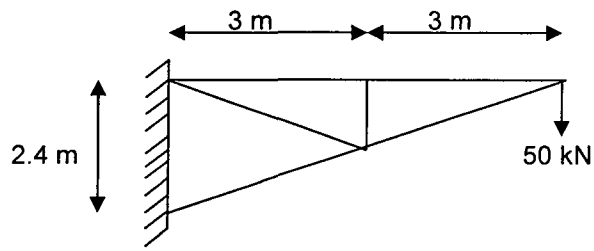

Fig. Q.13 (b)

14. (a) A beam ABC 9 m long is simply supported at A and B over a span of 7 m and the portion BC overhangs. It carries a point load of 12 kN at C, and a uniformly distributed load of 6 kN/m over the span AB. Draw the shearing force and bending moment diagrams and indicate all salient values.

(Or)

(b) A flitched beam is made up of two timber joists, each 60 mm wide and 100 mm deep, with a 10 mm thick and 80 mm deep steel plate placed symmetrically between them. Determine the total moment of resistance of the section if the permissible stress in the timber joist is 7 N/mm^2. Take the modular ratio between steel and timber as 20.

15. (a) A horizontal beam of uniform section and 8 m long is simply supported at its ends. The beam is subjected to a point load of 20 kN at 3 m from the left end and a clockwise concentrated moment of 8 kNm at 6 m from the left end. Find the maximum deflection in the beam using Macaulay's method.

(Or)

(b) A cantilever of span 4 m carries two point loads 12 kN and 8 kN at mid span and free end respectively. Determine the slope and deflection of the cantilever at the free end using conjugate beam method. Assume EI is uniform throughout.