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

Question Paper Code : 91289

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2019

Third Semester

Civil Engineering

CE 6302 – MECHANICS OF SOLIDS

(Common to Environmental Engineering)

(Regulations 2013)

Time : Three Hours | Maximum : 100 Marks

Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What is meant by Poisson's ratio ? Which material has the higher value of Poisson's ratio ?
2. Find the strain energy stored in an uniform bar subjected to axial force.
3. How do you relate intensity of loading, shearing force and bending moment ?
4. State the basic principles involved in the analysis of a composite beam.
5. Write the maximum value of deflection for a simply supported beam of constant EI, span L carrying central concentrated load W.
6. Where the maximum deflection will occur in a simply supported beam loaded with UDL of w kN/m run and what is the value ?
7. Define the term polar modulus.
8. Give the expression for stiffness of a closed helical spring.
9. What are the assumptions made in finding out the forces in a frame ?
10. What is meant by principal stress ?

PART – B **(5×13=65 Marks)**

11. a) When a square bar of certain material (40 mm × 40 mm in section) is subjected to an axial pull of 160 kN, the measured extension on a gauge length of 200 mm is 0.1 mm and the decrease in each side of the square bar is 0.005 mm. Calculate modulus of Elasticity, shear modulus and Bulk modulus for this materials.

(OR)

b) A 25 mm diameter brass bar is inserted in a hollow circular steel tube of 50 mm outer diameter and 25 mm internal diameter. Both bar and the tube are initially 1.5 m long. When the temperature of this assembly is raised by 50°C, flow the stresses induced in the two materials. The coefficients of thermal expansion for steel and copper are respectively 12×10^{-6}/°C and 18×10^{-6}/°C and modulus of elasticity are 200 GPa and 100 GPa respectively.

12. a) A simply supported beam of span 10 m carries a concentrated load of 10 kN at 2 m from the left support and a uniformly distributed load of 4 kN/m over the entire length. Sketch the shear force and bending moment diagrams for the beam.

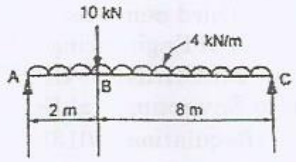

Fig.Q. 12(a)

(OR)

b) Find the dimensions of a timber joist span 5 m to carry a brick wall 200 mm thick and 3.2 m high, if the weight of brickwork is 19 kN/m^3 and the maximum stress is limited to 8 N/mm^2. The depth is to be twice the width.

13. a) A horizontal beam of uniform section and 6 m long is simply supported at its ends. The beam is subjected to a uniformly distributed load of 12 kN/m over the right half span. Find the maximum deflection in the beam using Macaulay's method.

(OR)

b) A cantilever of span 4 m carries two point loads 10 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.

14. a) Determine the diameter of solid shaft which will transmit 300 kW at 250 r.p.m. The maximum shear stress should not exceed 30 N/mm^2 and twist should not be more than 1^0 in a shaft length of 2 m. Take modulus of rigidity = 1×10^5 N/mm^2.

(OR)

b) A close coil helical spring of 10 cm mean diameter is made up of 1 cm diameter rod and has 20 turns. The spring carries an axial load of 200 N, Determine the shearing stress. Taking the value of modulus of rigidity = 8.4×10^4 N/mm^2, determine the deflection when carrying this load. Also calculate the stiffness of the spring.

15. a) Two planes AB and AC, which are right angles carry shear stress of intensity 17.5 N/mm^2 while these planes also carry a tensile stress of 70 N/mm^2 and a compressive stress of 35 N/mm^2 respectively as shown in the following figure, Q 15 (a). Determine the principal planes and the principal stresses. Also determine the maximum shear stress and planes on which it acts.

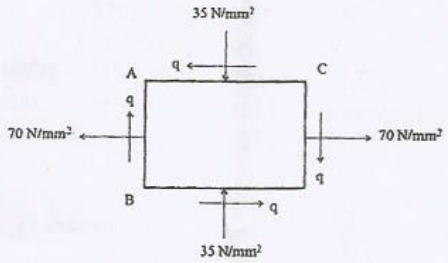

Fig Q. 15(a)

(OR)

b) The following figure Q. 15 (b) shows a warren girder consisting of seven members each of 4 m length supported at its ends and loaded as shown. Determine the forces in the members by method of joints.

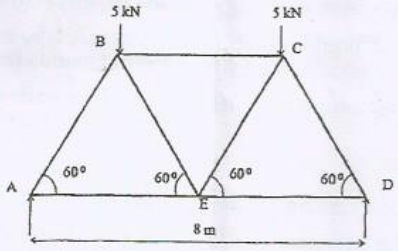

Fig Q. 15(b)

PART – C (1×15=15 Marks)

16. a) A thin cylindrical vessel of 1 m diameter carries a fluid under 5 N/mm^2 pressure. If the permissible tensile stress in the material of the cylinder is 120 N/mm^2, find the thickness required. Find also the other stress, change in diameter, length and volume of the cylinder if the length of the cylinder is 3 metres. E = 200 GPa and v = 0.3.

(OR)

b) A circular shaft is subjected to a torsional moment of 120 kNm and a bending moment of 60 kNm. Find the minimum diameter required if the maximum shear stress in the material is limited to 100 N/mm^2.