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Question Paper Code : X 20288

B.E./B.Tech. DEGREE EXAMINATIONS, NOV./DEC. 2020

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 factor of safety ?
2. Define Resilience.
3. How bending moment, shear force and intensity of loadings are related ?
4. Define the term 'moment of resistance'.
5. Write the maximum value of deflection for a cantilever beam of length L, constant EI and carrying concentrated load W at the end.
6. State the two theorems in Moment area method.
7. Why hollow circular shafts are preferred over solid circular shafts ?
8. Define Torsional rigidity.
9. What are principal planes ?
10. Enlist the assumptions made in analysis of a pin-joined plane truss.

PART – B **(5×13=65 Marks)**

11. a) The following data relate to a bar, subjected to a tensile test : Diameter of the bar = 30 mm ; Tensile Load = 54 kN ; Gauge length = 300 mm; Extension of the bar = 0.112 mm ; Change in diameter = 0.00366 mm. Calculate Poisson's ratio and the values of three modulii.

(OR)

b) A steel tube 2.4 cm external diameter and 1.8 cm internal diameter encloses a copper rod 1.5 cm diameter to which it is rigidly connected at the two ends. If at a temperature of 10°C, there is no longitudinal stress, calculate the stresses in the rod and the steel tube, when the temperature is raised to 200°C. Take $E_s = 2.1 \times 10^5$ N/mm^2 ; $E_c = 1 \times 10^5$ N/mm^2; $\alpha_s = 1.1 \times 10^{-5}$ per °C; $\alpha_c = 1.8 \times 10^{-5}$ per °C.

12. a) A 10 m long beam A B C is simply supported at B and C over a span of 8 m with end A being free. It carries point loads of 8 kN and 4 kN at distances 3 m and 5 m from C. The beam also has two uniformly distributed loads of intensity 4 kN/m for a distance of 4 m starting from C and of 6 kN/m on AB. Draw shearing force and bending moment diagrams indicating all principal 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 on vertical faces. 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.

13. a) A beam of length 6 m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left end support. Find the deflection under each load. Take $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ N/mm^4.

(OR)

b) A cantilever of length 2 m carries a point load of 20 kN at the free end and another load of 20 kN at its centre. If $E = 10^5$ N/mm^2 and $I = 10^8$ mm^4 for the cantilever then determine by moment area method, the slope and deflection of the cantilever at the free end.

14. a) A hollow shaft is to transmit 200 kW at 80 rpm. If the shear stress is not to exceed 70 MN/m^2 and internal diameter is 0.5 of the external diameter. Find the external and internal diameters assuming that maximum torque is 1.6 times the mean.

(OR)

b) A closed coil helical spring is to deflect 1 mm under the axial load of 100 N at shearing stress of 90 N/mm^2. The spring is to be made of round wire having rigidity modulus of 80×10^4 N/mm^2. The mean diameter of the spring is to be 10 times the diameter of the wire. Find the diameter and length of the wire necessary to form the spiring.

15. a) The stresses on two mutually perpendicular planes through a point on a body are 30 MPa and 20 MPa both tensile, along with a shear stress of 15 MPa. Find

i) The position of principal planes and stresses across them.

ii) The planes of maximum shear stress.

iii) The normal and tangential stress on the plane of maximum shear stress.

(OR)

b) Analyze the cantilevered truss shown in Fig. Q.15(b) by method of sections.

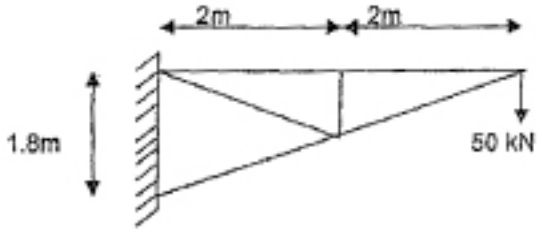

Fig. Q.15(b)

PART – C **(1×15=15 Marks)**

16. a) A steel girder of 6 m length acting as a simply supported beam carries a uniformly distributed load w N/m run throughout its length.

If $I = 30 \times 10^{-6}$ m^4 and depth 270 mm, calculate.

i) The magnitude of w so that the maximum stress developed in the beam section does not exceed 72 MN/m^2.

ii) The slope and deflection in the beam at a distance of 1.8 m from one end. Take : E = 200 GPa.

(OR)

b) A wagon weighing 18 kN is moving at 5 km/hr. How many springs each of 20 coils will be required in a buffer stop to absorb the energy of motion during a compression of 175 mm. The mean diameter of coils is 250 mm and the diameter of steel rod, comprising the coil is 22 mm. Take C = 82 GPa.

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