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Question Paper Code : 50260

B.E./B.Tech. DEGREE EXAMINATION, NOVEMBER/DECEMBER 2017
Third/Fourth Semester
Mechanical Engineering
CE 6306 – STRENGTH OF MATERIALS
(Common to Mechanical Engineering (Sandwich)/Agriculture Engineering/ Automobile Engineering/Industrial Engineering/Industrial Engineering and Management/Manufacturing Engineering/Materials Science and Engineering/ Mechanical and Automation Engineering/Mechatronics Engineering/Production Engineering)
(Regulations 2013)

Time : Three Hours **Maximum : 100 Marks**

Assume suitable data if found necessary.
Answer ALL questions.

PART – A **(10×2=20 Marks)**

1. What is a bulk modulus ?
2. Define the terms : Principal planes and Principal stresses.
3. Draw the S.F. and B.M. diagrams for a cantilever of length L carrying a point load W at the free end.
4. What is meant by flitched beam ?
5. Write the expression for polar modulus for a solid shaft and for a hollow shaft.
6. What is a spring ? Name the two important types of spring.
7. How will you use conjugate beam method for finding slope and deflection at any section of a given beam ?
8. State Maxwell's reciprocal theorem.

9. Define thin cylinders.

10. List the assumption made in *Lame's* theory.

PART – B **(5×13=65 Marks)**

11. a) A compound tube consists of a steel tube 140 mm internal diameter and 160 mm external diameter and an outer brass tube 160 mm internal diameter and 180 mm external diameter. The two tubes are of the same length. The compound tube carries an axial load of 900 kN. Find the stresses and the load carried by each tube and the amount it shortens. Length of each tube is 140 mm. Take E for steel as 2×10^5 N/mm^2 and for brass as 1×10^5 N/mm^2. **(13)**

(OR)

b) At a point in a strained material the principal stresses are 100 N/mm^2 (tensile) and 60 N/mm^2 (compressive). Determine the normal stress, shear stress and resultant stress on a plane inclined at 50° to the axis of major principal stress. Also determine the maximum shear stress at the point. **(13)**

12. a) A cantilever of length 2 m carries a uniformly distributed load of 2 kN/m length over the whole length and a point load of 3 kN at the free end. Draw the S.F. and B.M. diagrams for the cantilever. **(13)**

(OR)

b) A beam is simply supported and carries a uniformly distribute load of 40 kN/m run over the whole span. The section of the beam is rectangular having depth as 500 mm. If the maximum stress in the material of the beam is 120 N/mm^2 and moment of inertia of the section is 7×10^8 mm^4, find the span of the beam. **(13)**

13. a) A hollow shaft is to transmit 300 kW power at 80 r.p.m. If the shear stress is not exceed 60 N/mm^2 and the internal diameter is 0.6 of the external diameter, find the external and internal diameters assuming that the maximum torque is 1.4 times the mean. **(13)**

(OR)

b) A closely coiled helical spring made of 10 mm diameter steel wire has 15 coils of 100 mm mean diameter. The spring is subjected to an axial load of 100 N. Calculate : **(13)**

i) The maximum shear stress induced,

ii) The deflection and

iii) Stiffness of the spring,

Take modulus of rigidity = 8.16×10^4 N/mm^2.

14. a) A cantilever of length 3 m is carrying a point load of 50 kN at a distance of 2 m from the fixed end. If I = 10^8 mm^4 and E = 2×10^5 N/mm^2, find i) Slope at the free end and ii) Deflection at the free end. **(13)**

(OR)

b) A simply supported beam of length 5 m carries a point load of 5 kN at a distance of 3m from the left end. If E = 2×10^5 N/mm^2 and I = 10^8 mm^4, determine the slope at the left support and deflection under the point load using conjugate beam method. **(13)**

15. a) Calculate i) the change in diameter, ii) change in length and iii) change in volume of a thin cylindrical shell 100 cm diameter, 1 cm thick and 5 m long when subjected to internal pressure of 3 N/mm^2.
Take the value of E = 2×10^5 N/mm^2 and Poisson's ratio 0.3. **(13)**

(OR)

b) Determine the maximum and minimum hoop stress across the section of a pipe of 400 mm internal diameter and 100 mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the redial pressure distribution and hoop stress distribution. **(13)**

PART – C **(1×15=15 Marks)**

16. a) A load of 2 MN is applied on a short concrete column 500 mm × 500 mm. The column is reinforced with four steel bars of 10 mm diameter, one in each corner. Find the stresses in concrete and the steel bars.
Take E for steel as 2.1×10^5 N/mm^2 and for concrete as 1.4×10^5 N/mm^2. **(15)**

(OR)

b) A water main 80 cm diameter contains water at a pressure head of 100 m. If the weight density of water is 9810 N/m^3, find the thickness of the metal required for the water main. Given the permissible stress as 20 N/mm^2. **(15)**

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