CBCS SCHEME

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18CV32

Third Semester B.E. Degree Examination, Dec.2019/Jan.2020
Strength of Materials

Time: 3 hrs. Max. Marks: 100

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the four elastic constants. **(06 Marks)**

b. Derive an expression for the displacement of a tapering circular bar subjected to an axial force. **(08 Marks)**

c. The modulus of elasticity and shear modulus of a bar is 200Gpa and 80Gpa respectively. Compute the bulk modulus and reduction in diameter of a circular bar 36mm diameter and 3m long, when stretched by 3mm. **(06 Marks)**

OR

2 a. Write a note on temperature stress in simple bars. **(05 Marks)**

b. Derive the relation between modulus of elasticity, modulus of rigidity and Poisson's ratio. **(08 Marks)**

c. A composite tube consists of a steel tube 165mm internal diameter and 15mm thick enclosed by an aluminium tube 200mm internal diameter and 15mm thick. The composite tube carries an axial load of 1500kN. Compute the stresses in each material, load carried by each material and the compression of the composite tube, if its length is 300mm. E_s = 200Gpa and E_{AL} = 70Gpa. **(07 Marks)**

Module-2

3 a. Explain maximum shear stress theory of failure. **(06 Marks)**

b. A closed cylindrical steel vessel 8m long and 2m internal diameter is subjected to an internal pressure of 5MPa with the thickness of the vessel being 36mm. Compute hoop stress, longitudinal stress, maximum shear stress, change in length, change in diameter and change in volume. Assume E = 200 kN/mm^2 and μ = 0.3. **(08 Marks)**

c. An element is subjected to a tensile stress of 120N/mm^2 on the vertical plane and another compressive stress of 80N/mm^2 on the horizontal plane. Compute the normal and tangential stresses on a plane making an angle of 30° anticlockwise with the vertical plane. **(06 Marks)**

OR

4 a. The stresses acting at a point in a two dimensional system is shown in Fig.Q4(a). Determine the principal stresses and planes, maximum shear stress and planes, normal and shear stresses on plane AB. **(10 Marks)**

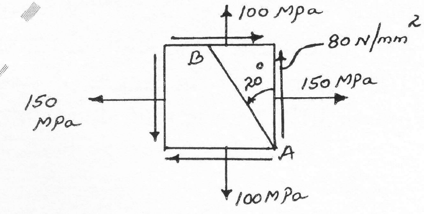

Fig.Q.4(a)

b. Differentiate between thin and thick cylinders. **(03 Marks)**

c. Compute the thickness of the wall of a thick cylinder subjected to an internal pressure of 40 N/mm^2. The internal diameter of the cylinder is 200mm and the permissible hoop stress is 140MPa. Sketch the hoop stress and radial pressure across the thickness assuming zero external pressure. **(07 Marks)**

Module-3

5 a. Define SF, BM and point of contraflexure. **(03 Marks)**

b. A simply supported beam AB of span L is subjected to a concentrated load at distance 'a' from left support A. Develop expressions for SF and BM. Sketch SFD and BMD. **(05 Marks)**

c. Sketch SFD and BMD for the beam shown in Fig.Q.5(c) indicating the salient points. **(12 Marks)**

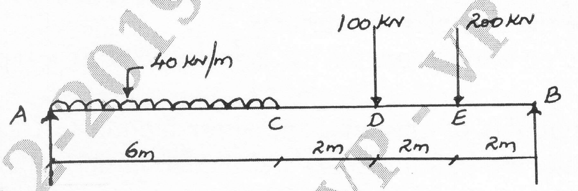

Fig.Q.5(c)

OR

6 a. Sketch SFD and BMD for the beam shown in Fig.Q.6(a) indicating salient points.

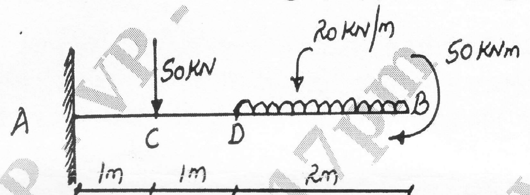

Fig.Q.6(a)

(08 Marks)

b. Sketch SFD and BMD for the beam shown in Fig.Q.6(b) indicating salient points including point of contraflexure. **(12 Marks)**

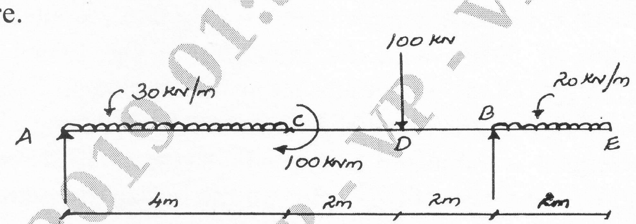

Fig.Q.6(b)

Module-4

7 a. Derive the equation of pure bending $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notations. **(10 Marks)**

b. A shaft of hollow C/S rotates at 200rpm transmitting a power of 800kW with internal diameter = 0.8 times external diameter. Computer the diameters if the maximum shear stress is limited to 100N/mm^2 and the angle of twist to 1° in a length of 4m. Assume that the maximum torque is 30% greater than the mean torque and G = 80GPa. **(10 Marks)**

OR

8 a. State the assumptions made in the theory of pure torsion. **(05 Marks)**

b. Derive an expression for power transmitted by a shaft. **(05 Marks)**

c. A I-section consists of flanges 200 × 15 with web 10mm thick. Total depth of the section is 500mm. If the beam carries a UDL of 35kN/m over a span of 8m, computer the bending and shear stresses at centre and support respectively. Sketch their distributions. **(10 Marks)**

Module-5

9 a. Derive an expression for slope and deflection in a simply supported subjected to UDL throughout. Calculate the maximum slope and deflection. **(06 Marks)**

b. Define:

i) Buckling load

ii) Effective length

iii) Slenderness ratio. **(06 Marks)**

c. Compute the crippling loads using Euler's and Rankine's formula for a hollow circular column 200mm external diameter and 25mm thick. The length of the column is 4m with both ends hinged. Assume E = 200GPa, Rankine's constants σ_c = 320MPa and a = 1/7500. **(08 Marks)**

OR

10 a. Derive an equation for buckling load in a long column with both ends hinged using Euler's column theory. **(08 Marks)**

b. Determine the slopes at A and B, deflections at C, D and E in the beam shown in Fig.Q.10(b) in terms of EI. **(12 Marks)**

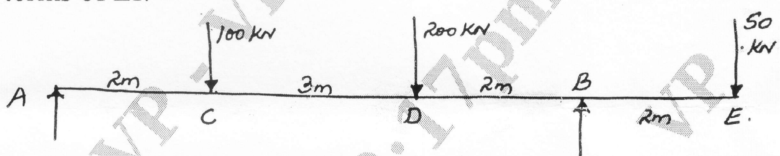

Fig.Q.10(b)

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