CBCS SCHEME

USN | | | | | | | | | |

15CV/CT32

Third Semester B.E. Degree Examination, July/August 2022
Strength of Materials

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer any FIVE full questions, choosing ONE full question from each module.***
2. ***Assume missing data suitably.***

Module-1

1 a. Draw a neat sketch of Stress – Strain curve for mild steel specimen subjected to axial tensile test and mark the salient points on it. **(04 Marks)**

b. Derive the relationship between Modulus of Rigidity and Modulus of Elasticity. **(06 Marks)**

c. A 2.5m long steel bar having uniform diameter of 40mm for a length of 2m and in the next 0.5m its diameter gradually reduces to 20mm. Determine the elongation of the bar when subjected to an axial tensile load of 160kN. Take E = 200 GPa. **(06 Marks)**

OR

2 a. Define the following : i) Bulk Modulus ii) Poisson's ratio iii) Modulus of Elasticity iv) Volumetric strain. **(04 Marks)**

b. Derive an expression for the deformation of the tapering circular cross sectional bar subjected to an axial Force 'P'. Use Standard notations. **(06 Marks)**

c. A steel rod is 20m long at 20°C. Find the Free expansion the temperature is raised to 70°C. Also find the temperature stress produced when i) The expansion is fully restrained
ii) The rod is permitted to expand by 5mm. Take E = 200 GPa and $\alpha = 12 \times 10^{-6}$/°C. **(06 Marks)**

Module-2

3 a. Define Principal Stresses and Principal Planes. **(04 Marks)**

b. Derive an expression for circumferential stress developed in a thin cylindrical shell subjected to Internal pressure 'P'. **(04 Marks)**

c. In an elastic material the stresses acting on an elementary block are as shown in Fig. Q3(c). Compute i) Principal stresses and Principal planes.
ii) Normal and Tangential stress on plane AC. **(08 Marks)**

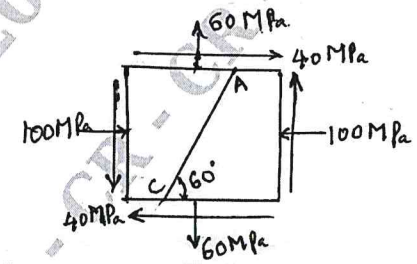


Fig. Q3(c)

OR

4 a. Differentiate between Thin and Thick cylinders. **(04 Marks)**

b. Show that Principal planes and Maximum shearing planes are inclined at 45° with each other. **(04 Marks)**

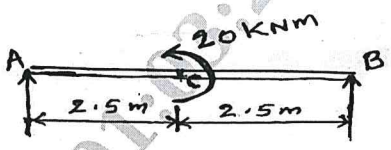
c. A thick walled cylindrical pressure vessel has inner radius of 150mm and outer radius of 185mm. Draw a sketch, showing the radial pressure and hoop stress distribution in the section of the cylinder wall, when an internal pressure of 10MN/m^2 is applied. **(08 Marks)**

Module-3

5 a. Define i) Bending Moment ii) Shear Force. **(04 Marks)**

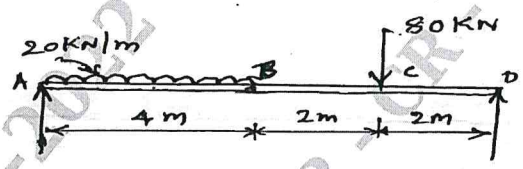
b. Draw the SFD and BMD for the beam shown in Fig. Q5(b). **(04 Marks)**

Fig. Q5(b)



c. Draw SFD and BMD for the loaded beam shown in Fig. Q5(c). **(08 Marks)**

Fig. Q5(c)



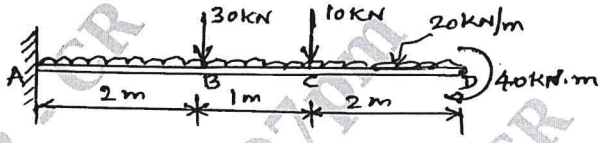
OR

6 a. Explain the terms : i) Sagging Bending moment ii) Hogging Bending moment. **(04 Marks)**

b. Derive the relation between Intensity of load, Shear force and Bending moment. **(04 Marks)**

c. A Cantilever is subjected to the loads as shown in Fig. Q6(c). Draw SFD and BMD. **(08 Marks)**

Fig. Q6(c)

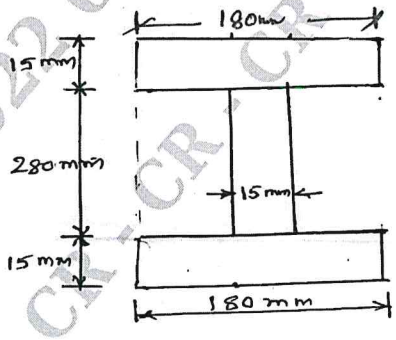


Module-4

7 a. State the assumptions made in Pure Bending theory. **(04 Marks)**

b. A beam with I Section as shown in Fig. Q7(b) is subjected to a bending moment of 120KNm and a Shear force of 60KN. Determine the bending stress and Shear stress distribution across the depth of the section. **(12 Marks)**

Fig. Q7(b)



OR

8 a. Explain the terms : i) Section Modulus ii) Moment of Resistance. **(04 Marks)**

b. Differentiate between Long Columns and Short Columns. **(04 Marks)**

c. A 2.5m long column with hallow circular section is hinged at both ends. External diameter is 140mm and thickness of wall is 20mm. Taking E = 80 GPa, a = $\frac{1}{1600}$ and σ_c = 550 MPa. Compare the Buckling loads obtained using Euler's formula and Rankine's formula. **(08 Marks)**

Module-5

9 a. Explain the terms : i) Polar Modulus ii) Torsional Rigidity. **(04 Marks)**

b. List the Common theories of Failure and explain the Maximum Principal Stress theory (Rankines's theory). **(06 Marks)**

c. A 60mm diameter Solid shaft is subjected to a torque 3KN – m. Determine Maximum shear stress induced and Angle of twist in 1 mtr , Length of the shaft. Take G = 80 KN/mm^2. **(06 Marks)**

OR

10 a. State and explain the Maximum Strain Energy theory (Haigh's theory). **(04 Marks)**

b. List the assumptions made in the theory of Pure Torsion. **(04 Marks)**

c. A Solid circular shaft has to transmit power of 1000KW at 120 rpm. Find the diameter of the shaft if the Shear stress must not exceed 80N/mm^2. Maximum torque is 1.25 times the mean. What percentage of material by weight is saved if the solid shaft is replaced by a hallow one, whose internal diameter is 0.6 times the external diameter. The length and maximum shear stress being same. **(08 Marks)**

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