CBCS SCHEME

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15CV/CT32

Third Semester B.E. Degree Examination, Jan./Feb. 2021
Strength of Materials

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. State and explain Elastic constants. **(04 Marks)**

b. A bar of 20mm is tested in tension. It is observed that when a load of 40kN is applied, the extension measured over a gauge length of 200mm is 0.12mm and contraction in diameter is 0.0036min. Find Poisson's ratio and elastic constants E, C, K. **(12 Marks)**

OR

2 a. Define temperature stresses and state its importance. **(06 Marks)**

b. A composite bar is rigidly fitted at the supports A and B as shown in the Fig.Q.2(b). Determine the reactions at the supports when temperature rises by 20°C. Take $E_a = 70\ GN/m^2$, $E_s = 200\ GN/m^2$, $\alpha_a = 11 \times 10^{-6}/°C$ and $\alpha_s = 12 \times 10^{-6}/°C$. **(10 Marks)**

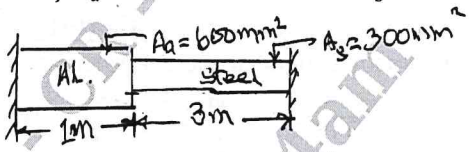

Fig.Q.2(b)

Module-2

3 a. Define principal planes and principal stresses. **(04 Marks)**

b. Stresses acting at a point in a two dimensional stress system shown in the Fig.Q.3(b), find:

i) Normal and shear stresses on the inclined plane
ii) Principal stresses and their planes
iii) Maximum shear stresses and their planes.

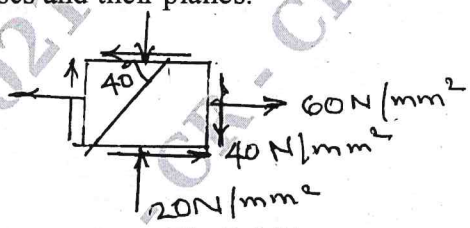

Fig.Q.3(b)

(12 Marks)

OR

4 a. Derive expressions for hoop stress and longitudinal stress in a thin cylinder. **(06 Marks)**

b. A cylindrical thin shell 800mm diameter and 3m long is having 10mm metal thickness. The shell is subjected to an internal pressure of $2.5N/mm^2$. Determine:

i) Change in diameter
ii) Change in length
iii) Change in volume

Take $E = 2 \times 10^5 N/mm^2$ $\mu = 0.3$ **(10 Marks)**

Module-3

5 a. Derive the relationship between intensity of load, shear force and bending moment. **(06 Marks)**

b. Draw shear force and bending moment diagrams for the beam shown in the Fig.Q.5(b).

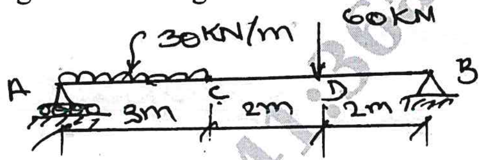

Fig.Q.5(b)

(10 Marks)

OR

6 a. Explain:
  i) Sagging bending moment
  ii) Hogging bending moment
  iii) Point of contra flexure. **(06 Marks)**

b. Draw shear force and bending moment diagrams for the beam shown in the Fig.Q.6(b). Locate the points of contra flexure. **(10 Marks)**

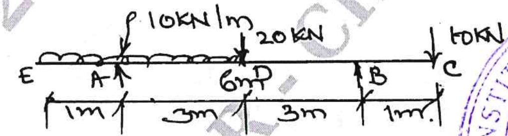

Fig.Q.6(b)

Module-4

7 a. What are assumptions made in bending theory? **(04 Marks)**

b. Derive the bending equation $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$ with usual notations. **(06 Marks)**

c. Prove that maximum shear stress is 1.5 times the average shear stress in rectangular section. **(06 Marks)**

OR

8 a. What is effective length of column? How it is related with end conditions of column and explain with neat sketches. **(08 Marks)**

b. A hollow cast iron column whose outside diameter is 200mm and has a thickness of 20mm, 4.5m long and is fixed at both ends. Evaluate Rankine's crippling load using $f_c = 550 N/mm^2$. Take Rankines constant $\frac{1}{1600}$. **(08 Marks)**

Module-5

9 a. Derive the Torsion equation $\frac{I}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$ with usual notation. **(06 Marks)**

b. A solid circular shaft is to be designed to transmit 440kW power at 280rpm. If the maximum shear stress is not to exceed $40 N/mm^2$ and the angle of twist is not to exceed 1° per meter length, determine the diameter of the shaft. Take modulus of rigidity $84 kN/mm^2$. **(10 Marks)**

OR

10 a. Explain: i) Maximum principal stress theory ii) Maximum shear stress theory. **(06 Marks)**

b. A bolt is required to resist an axial tension of 25kN and a transverse shear of 20kN. Find the size of the bolt by using i) Maximum principal stress theory ii) Maximum shear stress theory $\sigma_e = 300 N/mm^2$, F.S = 3 **(10 Marks)**

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