CBCS SCHEME

USN | | | | | | | | | | |

15CV/CT32

Third Semester B.E. Degree Examination, June/July 2019
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. Define : (i) Modulus of Rigidity (ii) Poisson's ratio **(04 Marks)**

b. Prove that the total extension of a uniformly tapering rod of diameter D_1 and D_2 , when the rod is subjected to an axial load 'P' is given by $dl = \frac{4PL}{\pi E D_1 D_2}$. **(06 Marks)**

c. An axial pull of 40,000 N is acting on a bar consisting of three sections of length 300mm, 250mm and 200mm and of diameters 20mm, 40mm and 50mm respectively. If the Young's modulus = 2×10^5 N/mm^2, determine (i) Stress in each section (ii) total extension of the bar. **(06 Marks)**

OR

2 a. Explain elasticity and elastic limit. **(04 Marks)**

b. A steel bar 300mm long, 50mm wide and 40mm thick is subjected to a pull of 300 kN in the direction of its length. Determine the change in volume. Take E = 2×10^5 N/mm^2 and Poisson's ratio = 0.25. **(06 Marks)**

c. A reinforced short concrete column 250mm × 250mm in section is reinforced with 8 steel bars. The total area of steel bars is 2500 mm^2. The column carries a load of 390 kN. If the modulus of elasticity for steel is 15 times that of concrete. Find the stresses in concrete and steel. **(06 Marks)**

Module-2

3 a. Differentiate between thin cylinder and a thick cylinder. Find an expression for the radial pressure and hoop stress at any point in case of a thick cylinder. **(10 Marks)**

b. A rectangular bar of cross section area of 11,000 mm^2 is subjected to a tensile load 'P' as shown in Fig.Q3(b). The permissible normal and shear stresses on the oblique plane BC are given as 7 N/mm^2 and 3.5 N/mm^2 respectively. Determine the safe value of 'P'. **(06 Marks)**

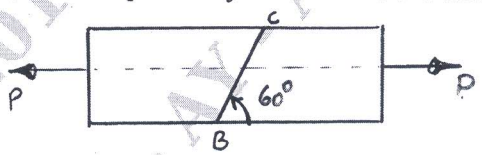

Fig.Q3(b)

OR

4 a. Determine the maximum and minimum hoop stress across the section of a pipe 400mm internal diameter and 100mm thick, when the pipe contains a fluid at a pressure of 8 N/mm^2. Also sketch the radial pressure distribution and hoop stress distribution across the section. **(08 Marks)**

b. At a point in a strained material the principal tensile stresses across two perpendicular planes are 80 N/mm^2 and 40 N/mm^2. Determine normal stress, shear stress and the resultant stress on a plane inclined at 20° with the major principal plane. Determine also the obliquity. **(08 Marks)**

Module-3

5 a. Define (i) Shear force (ii) Bending moment. **(02 Marks)**

b. Draw the SF and BM diagrams for a cantilever of length 'L' carrying a point load 'W' at the free end. **(04 Marks)**

c. Draw the SF and BM diagrams of a simply supported beam of length 7 mt carrying uniformly distributed loads as shown in Fig.Q5(c). **(10 Marks)**

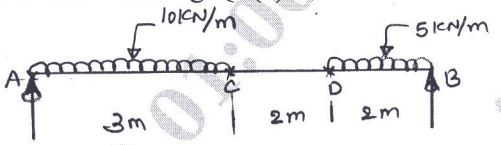

Fig.Q5(c)

OR

6 A horizontal beam 10mt long is carrying a uniformly distributed load of 1 kN/m. The beam is supported on two supports 6 mt apart. Find the position of the supports, so that bending moment on the beam is as small as possible. Also draw the SF and BM diagram. **(16 Marks)**

Module-4

7 a. Define the terms : (i) Neutral axis (ii) Section modulus. **(04 Marks)**

b. A hollow mild steel tube 6m long 40mm internal diameter and 5mm thick is used as a strut with both ends hinged. Find the crippling load and safe load taking factor of safety as 3. Take $E = 2\times10^5$ N/mm^2. **(06 Marks)**

c. The external and internal diameter of a hollow cast iron column are 50mm and 40mm respectively. If the length of this column is 3m and both of its ends are fixed, determine the crippling load using Rankine's formula. Take the values of $\sigma_c = 550$ N/mm^2 and $\alpha = \frac{1}{1600}$ in Rankine's formula. **(06 Marks)**

OR

8 a. Define (i) Buckling load (ii) Slenderness ratio. **(04 Marks)**

b. A timber beam of rectangular section of length 8m is simply supported. The beam carries a U.D.L. of 12 kN/m ran over the entire length and a point load of 10 kN at 3m from the left support. If the depth is two times the width and the stress in the timber is not to exceed 8 N/mm^2, find the suitable dimensions of the section. **(12 Marks)**

Module-5

9 a. List the theories of failures. **(04 Marks)**

b. A hollow shaft of external diameter 120mm transmits 300 kW power at 200 r.p.m. Determine the maximum internal diameter if the maximum stress in the shaft is not to exceed 60 N/mm^2. **(06 Marks)**

c. Determine the diameter of a solid steel shaft which will transmit 90 kW at 160 r.p.m. Also determine the length of the shaft if the twist must not exceed 1° over the entire length. The maximum shear stress is limited to 60 N/mm^2. Take the value of modulus of rigidity = 8×10^4 N/mm^2. **(06 Marks)**

OR

10 a. Derive the relation for a circular shaft when subjected to a torsion as given below:

$$\frac{T}{J} = \frac{\tau}{R} = \frac{C\theta}{L}$$ **(08 Marks)**

b. State and explain theory of maximum principal strain theory. **(08 Marks)**

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