ACHARYA INSTITUTE OF TECHNOLOGY
Bangalore - 560090

CBCS Scheme

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

15AU34

Third Semester B.E. Degree Examination, Dec.2016/Jan.2017
Mechanics 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. With usual notations derive an expression $dL = \frac{4PL}{\pi E d_1 d_2}$ for uniformly tapering circular section. **(06 Marks)**

b. A copper bar shown in figure is subjected to a tensile load of 30kN. Determine the elongation of the each bar if $E = 1 \times 10^5$ N/mm^2. **(10 Marks)**

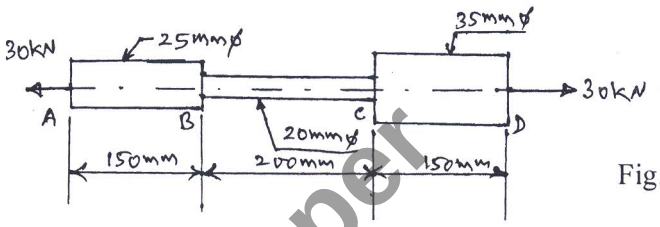

Fig. Q.1(b)

OR

2 a. With usual notation derive $E = 3K(1-2\mu)$. **(06 Marks)**

b. In an experiment, a bar of 30mm diameter is subjected to a pull of 60kN. The gauge length is 200mm, elongation is 0.09mm and change in diameter is 0.0039mm. Calculate the Poisson's ratio and value of the three modulii. **(10 Marks)**

Module-2

3 a. Define Principal planes, Principal stresses and explain their uses. **(06 Marks)**

b. The stresses at a point in a component are 100MPa (tensile) and 50MPa compressive. Determine the magnitude of normal and shear stresses on a plane inclined at an angle of 25^0 with tensile stress. Also determine the direction of the resultant stress and the magnitude of the maximum intensity of shear stress. **(10 Marks)**

OR

4 a. Deduce the expressions for circumferential and longitudinal stresses developed in thin cylinder due to internal pressure. **(06 Marks)**

b. A cylindrical vessel 2m long and 500mm in diameter with 10mm thick plates is subjected to an internal pressure of 3MPa. Calculate the changes in volume of the vessel. Take $E = 2 \times 10^5$N/mm^2. And Poisson's ratio = 0.3 for vessel material. **(10 Marks)**

Module-3

5 a. Give different types of beams and loads. **(04 Marks)**

b. Define Shear force and Bending moment. **(04 Marks)**

c. A simply supported beam AB of span 2.5m long is carrying two loads at C & D. Given AC = 1m and BD = 1m. Load at C & D are 2 kN and 4kN. Determine the S.F and BM at A, B, C & D. **(08 Marks)**

OR

6 a. Deduce the relation $\frac{\sigma_b}{Y} = \frac{M}{I} = \frac{E}{R}$ with the assumptions made in the derivation. **(08 Marks)**

b. A timber beam of rectangular section supports a load of 20kN uniformly distributed over a span of 3.6m. If depth of the beam section is twice the width and maximum stress is not to exceed 7MPa, find the dimensions of the beam section. **(08 Marks)**

Module-4

7 a. Explain the terms Torsion and Polar modus. **(06 Marks)**

b. A solid shaft is subjected to a torque of 1.6kNm. Find the necessary diameter of the shaft, if the allowable shear stress is 60MPa. The allowable twist is 1° for every 20 diameters length of the shaft. Take C = 80GPa. **(10 Marks)**

OR

8 a. What do you understand by column and strut? Explain their failure. **(08 Marks)**

b. A hollow alloy tube 4m long with external and internal diameters of 40mm & 25mm respectively was found to extend 4.8mm under a tensile load of 60kN. Find the buckling load for the tube with both ends pin jointed. Also find the safe load on the tube, taking a factor of safety as 5. **(08 Marks)**

Module-5

9 a. Define the following : i) Strain energy ii) Resilience iii) Proof resilience iv) Modulus of resilience. **(04 Marks)**

b. Derive an expression for strain energy stored in a body applied with a gradually applied load. **(06 Marks)**

c. Calculate the strain energy stored in a bar 2m long, 50mm wide and 40mm thick when it is subjected to a tensile load of 60kN. Take E = 200GPa. **(06 Marks)**

OR

10 a. Enumerate different theories of failures. **(02 Marks)**

b. Explain maximum principal stress theory and maximum shear stress theories. Give their applications. **(14 Marks)**

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