CBCS Scheme

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

15AU34

Third Semester B.E. Degree Examination, June/July 2018
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. Define the following :
- i) Elasticity
- ii) Ductility
- iii) Toughness
- iv) Hardness
- v) Stiffness
- vi) Resilience. **(06 Marks)**

b. The stepped bar shown in Fig Q1(b) is subjected to a pull of 25kN. The bar is made up of two different materials having Young's modulus E_1 = 200GPa and E_2 = 100GPa. Find the extension of the bar and stresses in each materials.

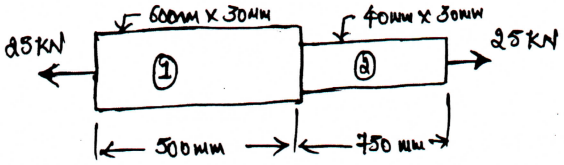

Fig Q1(b) **(10 Marks)**

OR

2 a. Show the relation between Young's modulus and modulus of Rigidity. **(08 Marks)**

b. At room temperature, the gap between bar A and bar B shown in Fig Q2(b) is 0.25mm. What are the stresses induced in the bars, if the temperature rise is 35°C. Given A_A = 1000mm^2 ; AB = 800mm^2 ; E_A = 2 × 10^5 N/mm^2 ; E_B = 1 × 10^5 N/mm^2 ; α_A = 12 × 10^{-6} /°C ; α_B = 23 × 10^{-6}/°C ; L_A = 400mm ; L_B = 300mm.

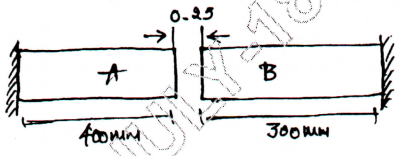

Fig Q2(b) **(08 Marks)**

Module-2

3 a. Explain:
- i) Principal planes and principle stresses and
- ii) Maximum and Minimum shear stresses with respect to compound stresses. **(08 Marks)**

b. Describe the construction of Mohr's circle for plane stress. **(08 Marks)**

OR

4 a. A thin cylindrical shell with following dimensions is filled with a liquid at atmospheric pressure. Length = 1.2m, External diameter = 200mm, Thickness of metal = 8mm. Find the value of the pressure exerted by the liquid on the walls of the cylinder and the hoop stress induced if an additional volume of 25000mm^3 of liquid is pumped into the cylinder. Take E = 2.1 × 10^5 N/mm^2 and μ = 0.33. **(08 Marks)**

b. Explain the concept of circumferential stress and longitudinal stress corresponding to thin cylinders. **(08 Marks)**

Module-3

5 For the beam shown in Fig Q5. Draw shear force and bending moment diagram. Locate the point of contra flexure if any.

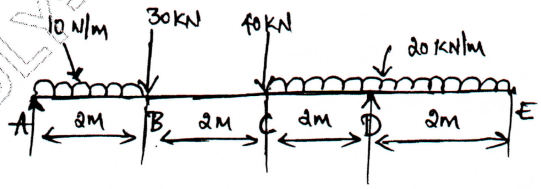

Fig Q5 **(16 Marks)**

OR

6 a. Derive a relationship between bending stress and radius of curvature. **(08 Marks)**

b. Derive the deflection equation, $EI = \frac{d^2y}{dx^2} = M$ **(08 Marks)**

Module-4

7 a. Derive the torque equation with usual Notations. **(06 Marks)**

b. A solid circular shaft has to transmit a power of 1000kW at 120 rpm. Find the diameter of the shaft, if the shear stress of the material must not exceed 80N/mm^2. The maximum torque 1.25time of its mean. What percentage of saving in material would be obtained if the shaft is replaced by hollow one whose internal diameter is 0.6 times its external diameter, the length, material and maximum shear stress being same? **(10 Marks)**

OR

8 a. Derive a Euler's Crippling load for a column when both of its ends are hinged. **(08 Marks)**

b. A 1.5m long column has a circular cross section of 50mm diameter. One end of the column is fixed in direction and position and the other end is free. Taking the factor of safety as 3, calculate the safe load using Euler's formula. Taking $E = 1.2 \times 10^5$ N/mm^2. **(08 Marks)**

Module-5

9 a. Derive an expression for strain energy due to shear stress. **(08 Marks)**

b. Write a note on Castigliano's theorem I and II. **(04 Marks)**

c. Define modulus of resilience of strain energy. **(04 Marks)**

OR

10 a. Determine the strain energy and hence the deflection at the free end of a cantilever beams of length L carrying a point load 'W' at its free end. **(08 Marks)**

b. Explain :

i) Maximum principal stress theory

ii) Maximum shear stress theory. **(08 Marks)**

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