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.

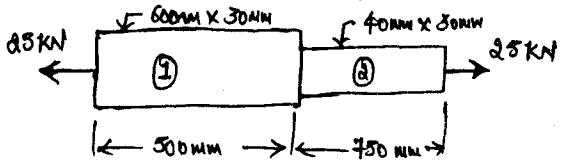

Fig Q1(b) **(10 Marks)**

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 $A_A = 1000mm^2$; $AB = 800mm^2$; $E_A = 2 \times 10^5$ N/mm^2 ; $E_B = 1 \times 10^5$ N/mm^2 ; $\alpha_A = 12 \times 10^{-6}$ /°C ; $\alpha_B = 23 \times 10^{-6}$/°C ; L_A = 400mm ; L_B = 300mm.

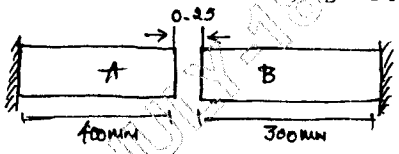

Fig Q2(b) **(08 Marks)**

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.

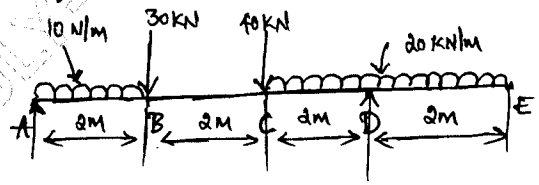

Fig Q5 **(16 Marks)**

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 o the shaft, if the shear stress of the material must not exceed 80N/mm^2. The maximum torqu 1.25time of its mean. What percentage of saving in material would be obtained if the shaft i 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 colum 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 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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