Code No. : 3284

FACULTY OF ENGINEERING
B.E. 2/4 (Mech./Prod) I Semester (Main) Examination, December 2010
MECHANICS OF MATERIALS

Time : 3 Hours] [Max. Marks : 75

*Note : 1) Answer **all** questions from Part – A*

*2) Answer **any five** questions from Part – B.*

PART – A **(25 Marks)**

1. Multiple choice : 2

i) A rod of length l is subjected to a rise of temperature T °C is permitted to expand only by δ. If α is the coefficient of thermal expansion , then temperature strain is

a) $\alpha T(l-\delta)/l$ b) $\alpha T(l+\delta)/l$

c) $(\alpha Tl-\delta)/(\alpha Tl)$ d) $(\alpha Tl-\delta)/l$

ii) The maximum BM for eccentrically loaded hinged columns for effective length L using secant formula is

a) $M = Pe.\sec L\sqrt{\frac{P}{2EI}}$ b) $M = Pe.\sec L\sqrt{\frac{2P}{EI}}$

c) $M = Pe.\sec\frac{L}{2}\sqrt{\frac{P}{EI}}$ d) $M = Pe.\sec\frac{L}{2}\sqrt{\frac{P}{2EI}}$

2. Fill up the blanks : 2

i) The shear stress along the principal planes is _____

ii) The intensity of loading w and shear force F at a section are related by equation _____

3. Define flexural rigidity and torsional rigidity. 2

4. Differentiate between thick and thin cylinders. 2

5. Define core of a section and explain its significance.

6. Draw the stress-strain curve for brittle steel specimen and explain how yield stress is obtained from it.

7. A triangular section beam with base width 150 mm and height 300 mm is subjected to a SF of 50 kN. Sketch the shear stress distribution across the section. 3

8. A cantilever carries a u.d.l. over the entire span 2 m. If the slope at the free end is 1°, find the deflection at the free end. Take $EI = 20 \times 10^6$ N-mm^2. 3

9. State the expressions for hoop stress and radial pressure at any radius x for a thick cylinder and sketch the distribution of the same. 3

10. Define the terms column, strut and crippling load. 3

PART – B (50 Marks)

11. A copper rod 36 mm diameter is enclosed with in steel tube 40 mm internal diameter and 5 mm thick, the ends being rigidly connected together. The combination is then heated through 30 °C. Find the intensity of stress in each metal. Take $\alpha_c = 16 \times 10^{-6}$ per °C, $\alpha_s = 12 \times 10^{-6}$ per °C, $E_c = 1.1 \times 10^5$ N/mm^2, and $E_s = 2 \times 10^5$ N/mm^2. 10

12. Construct SFD and BMD for the beam shown in Fig. 1. Mark the salient values therein. Also locate the points of contraflexure, if any. 10

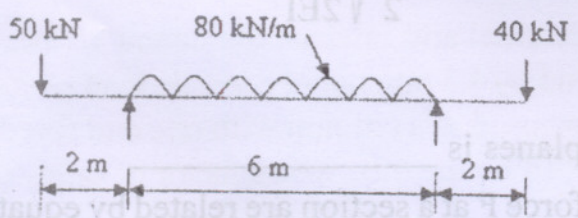

Fig.1

13. a) Derive an expression for deflection at free end for a cantilever of length / carrying a point load W at free end. 5

b) A cantilever beam of length 3 m carries a u.d.l. of 4 kN/m for a length of 2m from the fixed end and a point load of 5 kN at free end. If the section of the beam is 230 mm wide and 300 mm deep, find the deflection at the free end. Take E = 10 GPa. 5

14. a) Derive the governing equation for theory of simple torsion. 5

b) A hollow circular shaft, with internal diameter equals to half the external diameter, transmits 100 kW at 250 rps. Calculate the internal and external diameters if the twist in the shaft is not to exceed 2° in 3 m length of shaft and the shearing stress is limited to 60 MPa. 5

15. A T-section beam with 100 mm × 10 mm flange and 150 mm × 15 mm web is simply supported and subjected to a u.d.l. of 10 kN/m over its entire span 8 m. Draw the variation of shear stress across the depth of the beam at supports and obtain the maximum shear stress at the section. 10

16. A compound cylinder is composed of a tube 250 mm internal diameter and 25 mm thick shrunk on to a tube of 250 mm external diameter and 25 mm thick. The radial pressure at the junction is 10 N/mm^2. The compound cylinder is subjected to an internal fluid pressure of 80 N/mm^2. Find the variation of hoop stress over the wall of the compound cylinder. Calculate also the final stresses set up in the section. 10

17. a) Derive an expression for core a rectangular section and sketch the same. 5

b) A hollow alloy tube 5 m long with external and internal diameters 30 mm and 25 mm respectively was found to extend by 4.3 mm under a tensile load of 40 kN. Find the critical load for the tube when used as a column with one end fixed and the other end free. Also find the safe load for the tube with a factor of safety of 4. 5