No. of Printed Pages : 5 **BET-022**

Diploma in Civil Engineering (DCLE (G))
Diploma in Mechanical Engineering (DME)
DCLEVI/DMEVI/DELVI/DECVI/DCSVI/ ACCLEVI/ACMEVI/ACELVI/ACECVI/ACCSVI

Term-End Examination 03942

June, 2013

BET-022 : STRENGTH OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

Note : *Question no. 1 is **compulsory**. Attempt **any four** questions from the remaining questions. Assume suitable data wherever necessary and mention it clearly. Use of calculator is **allowed**.*

1. (a) Volumetric strain in a bar subjected to an axial load (W) is equal to : **7x2=14**

(i) $e(1 + 2\mu)$ (ii) $e(1 - 2\mu)$

(iii) $e(2 - \mu)$ (iv) $e(1 - 3\mu)$

Where e = linear strain and μ = Poission's's ratio.

(b) At a point in a strained material carrying two unequal unlike principal stresses p_1 & p_2 ($p_1 > p_2$) the maximum shear stress is given by :

(i) $\frac{p_1}{2}$ (ii) $\frac{p_2}{2}$

(iii) $\frac{(p_1 - p_2)}{2}$ (iv) $\frac{(p_1 + p_2)}{2}$

(c) The section modulus of a rectangular section having width (b) and depth (d) is :

(i) $\frac{bd}{2}$ (ii) $\frac{bd^2}{6}$

(iii) $\frac{bd^3}{6}$ (iv) $\frac{b^2d^2}{6}$

(d) When a section of a rectangular beam is subjected to a shearing force, the ratio of maximum shear stress to average shear stress is

(i) 2.0 (ii) 1.75

(iii) 1.5 (iv) 1.25.

(e) A beam of length (l) is simply supported over its both ends. It is carrying a uniformly distributed load of intensity 'w' unit length. Then its slope at ends will be :

(i) $\frac{w l^3}{24EI}$ (ii) $\frac{w l^4}{24EI}$

(iii) $\frac{5 w l^2}{24EI}$ (iv) $\frac{5 w l^3}{24EI}$

(f) If a shaft of diameter d is subjected to torque T, the maximum shear stress is :

(i) $\frac{32 T}{\pi d^3}$ (ii) $\frac{16 T}{\pi d^2}$

(iii) $\frac{16 T}{\pi d^3}$ (iv) $\frac{64 T}{\pi d^4}$

(g) If the span of a cantilever beam loaded with a uniformly distributed load is doubled and the intensity of the load is reduced to one-fourth of its value, the deflection at free end :

(i) gets double

(ii) remains same

(iii) becomes four times

(iv) None of the above.

2. A round tapered alloy bar 4.0m long is subjected to load as shown in figure. Find the change in the length of the bar. Take E = 120 GPa. **14**

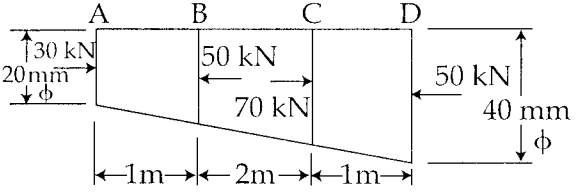

Figure - 1

3. A cantilever beam of 8m length is subjected to point loads of 10 kN, 15 kN, 25 kN and 20 kN at distances of 2m, 4m, 6m and 8m respectively from the fixed end. Draw the S.F and B.M. Diagram for the beam shown in figure 2. **14**

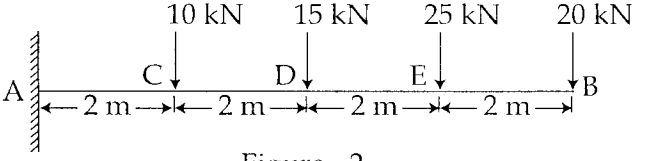

Figure - 2

4. An unequal I-section, shown in figure 3, is used as a beam. The beam section is subjected to a bending moment of 2.5kNm at its neutral axis. Find the maximum stress developed in the beam. **14**

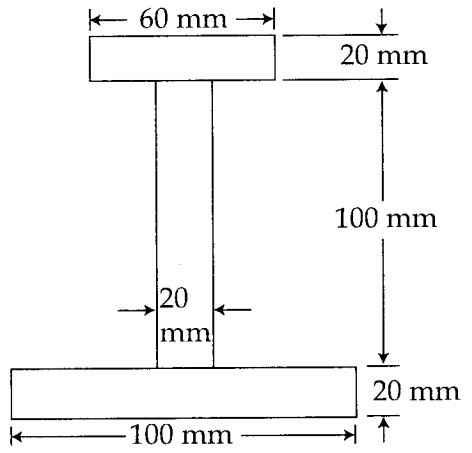

Figure - 3

5. An I-section has an overall depth of 240mm with horizontal flanges, each measuring 120mm × 20mm and a vertical web 200mm × 20mm. It is subjected to a vertical shear force of 200kN. Find the max. Shear stress & its position. Draw the shear stress distribution diagram for the section. **14**

6. (a) A simply supported beam of 4m span is carrying a uniformly distributed load of 2kN/m over the entire span. Find the maximum slope and deflection of the beam. Take EI = 80 x 10^9 N-$mm^2$for the beam. **7**

(b) A cantilever beam, 120mm wide and 150 mm deep, carries a uniformly distributed load of 10 kN/m intensity over its span of 2.4 meters. Find the slope and deflection of the beam of its free end. Take E = 180 GPa. 7

7. A solid steel shaft of 2m length is to transmit 50 kW at 150 rpm. If the shear stress in the shaft material is not to exceed 50 MPa and maximum allowable twist in the shaft is 1°, Calculate the required shaft diameter. Take G = 80 GPa. 14

8. An I-section joist shown in figure 4, is 6m long and is used as a strut with both ends fixed. What is Euler's cripling load for the column ? Take Young's modulus for joist as 200 GPa. 14

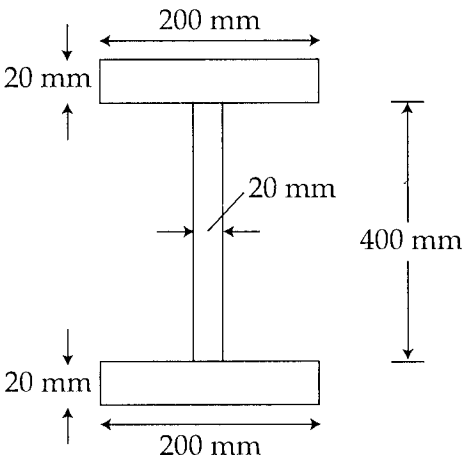

Figure - 4