

**DIPLOMA IN CIVIL ENGINEERING (DCLE(G)) /  
DIPLOMA IN MECHANICAL ENGINEERING  
(DME) / DCLEVI / DMEVI / DELVI / DECVI /  
DCSVI / ACCLEVI / ACMEVI / ACELVI /  
ACECVI / ACCSVI**

**Term-End Examination**

**June, 2016**

01380

**BET-022 : STRENGTH OF MATERIALS**

*Time : 2 hours*

*Maximum Marks : 70*

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

1. Choose the correct answer from the given alternatives :  $7 \times 2 = 14$

(a) Modulus of rigidity is defined as the ratio of

(i) longitudinal stress to longitudinal strain

(ii) shear stress to shear strain

(iii) stress to strain

(iv) stress to volumetric strain

(b) If the principal stresses at a point in a strained body are  $p_1$  and  $p_2$  ( $p_1 > p_2$ ), then the resultant stress on a plane carrying the maximum shear stress is equal to

(i)  $\sqrt{p_1^2 + p_2^2}$

(ii)  $\sqrt{\frac{p_1^2 + p_2^2}{2}}$

(iii)  $\sqrt{\frac{p_1^2 - p_2^2}{2}}$

(iv)  $\frac{\sqrt{p_1^2 + p_2^2}}{2}$

(c) The sum of normal stresses is

- (i) constant
- (ii) variable
- (iii) dependent on the planes
- (iv) None of the above

(d) A prismatic bar when subjected to pure bending assumes the shape of

- (i) catenary
- (ii) cubic parabola
- (iii) quadratic parabola
- (iv) arc of a circle

- (e) Buckling load for a given column depends upon
- (i) length of the column only
  - (ii) least lateral dimension only
  - (iii) both length and least lateral dimension
  - (iv) None of the above
- (f) Polar modulus for a solid shaft of diameter D is
- (i)  $\frac{\pi}{16} D^3$
  - (ii)  $\frac{\pi}{32} D^3$
  - (iii)  $\frac{\pi}{16} D^4$
  - (iv)  $\frac{\pi}{32} D^4$
- (g) If the length of a simply supported beam carrying a concentrated load at the centre is doubled, the deflection at the centre will become
- (i) two times
  - (ii) four times
  - (iii) eight times
  - (iv) sixteen times

2. A steel rod of 20 mm diameter passes centrally through a tight fitting copper tube of external diameter 40 mm. The tube is closed with the help of rigid washers of negligible thickness and nuts threaded on the rod. The nuts are tightened till the compressive load on the tube is 50 kN. Determine the stresses in the rod and the tube, when the temperature of the assembly falls by 50°C.

Consider,

- (a) for steel,  $E = 200 \text{ GNm}^{-2}$ ,  $\alpha = 12 \times 10^{-6} \text{ K}^{-1}$   
(b) for copper,  $E = 100 \text{ GNm}^{-2}$ ,  $\alpha = 18 \times 10^{-6} \text{ K}^{-1}$  14

3. A simply supported beam of 6 m span is loaded with a uniformly distributed load of 1.5 kN/m over the entire span and concentrated load of 4 kN and 5 kN at distances of 2 m and 4 m from the left hand support respectively. Find the magnitude and position of the maximum B.M. (Bending Moment). 14

4. A rectangular beam  $240 \times 400$  mm is simply supported over a span of 4 m. Find the safe concentrated load at mid-span, if the allowable bending stress is  $120 \text{ N/mm}^2$ . 14

5. A cantilever has prop P at a distance  $l$  from the fixed end and on this length there is a uniformly distributed load of  $w$  per unit run. If the prop is rigid and holds its point of application on the horizontal, find what proportion of the total weight is taken by the prop. 14

6. Find the maximum torque which can be applied safely to a shaft of 300 mm diameter. The permissible angle of twist is  $1.5^\circ$  in a length of 7.5 m and shear stress is not to exceed  $42 \text{ N/mm}^2$ . Take  $C = 84.4 \text{ kN/mm}^2$ . 14

7. Calculate the safe compressive load on a hollow cast-iron column with one end hinged and the other rigidly fixed. The external and internal diameters are 120 mm and 90 mm respectively and length of the column is 9 m. Take factor of safety as 3 and  $E = 95 \text{ GPa}$ . 14

8. Write short notes on any **four** of the following :  $4 \times 3 \frac{1}{2} = 14$

- (a) Stress - Strain Relationship
  - (b) Normal and Shear Stresses
  - (c) Evaluation of Extreme Stresses
  - (d) Torsion of Circular Shaft
  - (e) Factor of Safety
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