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 01580

December, 2012

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. Use of calculator is **allowed**.*

1. Choose the correct answer from the given alternatives : **7x2=14**

(a) The total change in length in a bar made of different sections is equal to the :

(i) sum of changes in lengths of different sections.

(ii) average of changes in lengths of different sections.

(iii) difference of changes in lengths of different sections.

(iv) none of the above

(b) The point of contraflexture is a point where :

(i) shear force changes sign.

(ii) bending moment changes sign.

(iii) shear force is maximum.

(iv) bending moment is maximum.

(c) Which of the following is a composite section ?

(i) Hollow circular section

(ii) T - section

(iii) Z - section

(iv) both (ii) and (iii)

(d) In a triangular section the maximum shear stress occurs at :

(i) apex of the triangle.

(ii) mid of the hight.

(iii) $\frac{1}{3}$rd of the hight.

(iv) base of the triangle.

(e) A simply supported beam of span l is carrying a point load W at its centre. The deflection of the beam at its centre is :

(i) $\frac{Wl^2}{12EI}$ (ii) $\frac{Wl^2}{16EI}$

(iii) $\frac{Wl^2}{24EI}$ (iv) $\frac{Wl^3}{48EI}$

(f) Polar moment of inertia of a solid shaft of diameter(d) is :

(i) $\frac{\pi}{16}d^3$ (ii) $\frac{\pi}{16}d^4$

(iii) $\frac{\pi}{32}d^4$ (iv) $\frac{\pi}{32}d^3$

(g) A column of length l is hinged at both ends. Its equivalent length will be equal to :

(i) $2\,l$ (ii) l

(iii) $0.5\,l$ (iv) $0.707\,l$

2. A reinforced concrete column, 500 mm × 500 mm in section, is reinforced with 4 steel bars of 25 mm diameter, one at each corner. The column is carrying a load of 1000 kN. Find the stresses in concrete and steel bars. Take Es = 210 GPa and Ec = 14 GPa. **14**

3. A simply supported beam AB, 6 m long is loaded as shown in figure. Construct the shear force and bending moment diagrams for the beam and find the position and value of max. bending moment. **14**

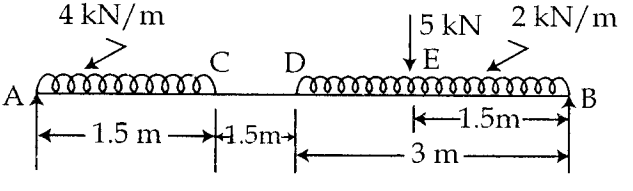
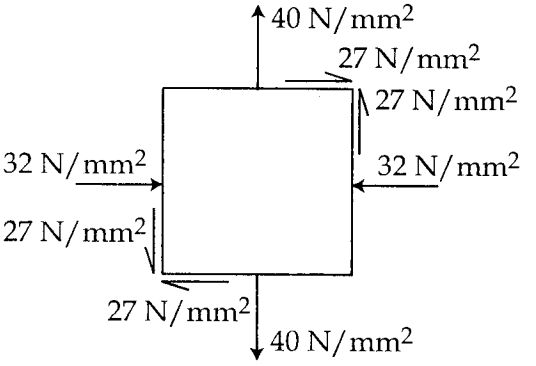


Figure - 1

4. Three beams have the same length, the same allowable stress and the same bending moment. The cross - sections of the beams are a square, a rectangle with depth twice the width and a circle of diameter 'd'. Find the ratios of weights of circular and rectangular beams with respect to square beam. **14**

5. A T - section has a flange of size 150mm × 50mm and web of size 50mm × 150mm. The section is subjected to a vertical shear force of 100 kN. Find the max. shear stress and draw shear stress distribution diagram with values at important points. Centroid of the section is 125 mm from the bottom face and moment of inertia about the centroidal axis is 5321.5×10^4 mm^4. **14**

6. Evaluate the principal stresses and principal planes for the state of stress shown in figure no.2. **14**



7. A solid shaft is subjected to a torque of 1.6 kNm. Find the necessary diameter of the shaft, if the allowable shear stress is 60 MPa. The maximum allowable twist for the shaft is 1° if the shaft length is 20 times its diameter. Take G = 80 GPa. **14**

8. Find the Euler's cripling load for a hollow cylindrical steel column of 38mm external diameter and 2.5mm thick. Take length of column as 2.3 m and the column to be hinged at its both ends. Take E = 205 GPa. **14**

   Also determine the cripling load by Rankine's formula using fc = 335 MPa and $a = \frac{1}{7500}$. Here fc = compressive stress and a = Rankine's constant.