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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

00273

June, 2018

BET-022 : STRENGTH OF MATERIALS

Time : 2 hours *Maximum Marks : 70*

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

1. Choose the correct answers from the alternatives given below : *7×2=14*

   (a) Poisson's ratio is defined as the ratio of

   (i) lateral strain to longitudinal strain

   (ii) longitudinal strain to lateral strain

   (iii) lateral strain to modulus of elasticity

   (iv) longitudinal strain to modulus of elasticity

(b) A prismatic bar of length 'L' of uniform cross-sectional area A is carrying an axial load P. Then its elongation is equal to

(i) P/AE

(ii) PL/AE

(iii) L/AE

(iv) AE/PL

(c) When a shear force at a section changes its sign, then bending moment at that section will be

(i) zero

(ii) minimum

(iii) maximum

(iv) infinity

(d) A rectangular section of a beam is subjected to shearing force. Then ratio of maximum stress to average stress is

(i) 0

(ii) 1

(iii) 4/3

(iv) 1·5

(e) A cantilever beam of length (l) is carrying a uniformly distributed load of intensity 'w' per unit length over its whole span. The slope at free end will be

(i) $wl^3/6$ EI

(ii) $wl^4/8$ EI

(iii) $wl^3/24$ EI

(iv) $wl^4/24$ EI

(f) The power of a shaft in watts can be expressed as

(i) 2π NT/4500

(ii) 2π NT/60

(iii) 2π NT/75

(iv) 2π NT

(g) The buckling load for a column is less than

(i) crippling load

(ii) critical load

(iii) crushing load

(iv) None of the above

2. (a) State the relationship between

(i) Young's modulus of elasticity (E) and Bulk modulus (K),

(ii) E and modulus of rigidity, and

(iii) Using the relations above, prove that

$$G = \frac{3\,KE}{9\,K - E}.$$

1+1+5=7

(b) In two separate experiments, Young's modulus (E) and Bulk modulus (K) of a material have been determined as 120 GPa and 100 GPa respectively. Calculate the Poisson's ratio (υ) and Modulus of rigidity (G). 7

3. At a point in a material, there is a horizontal tensile stress of 30 N/mm^2, a vertical tensile stress of 20 N/mm^2 and shearing stress of 50 N/mm^2 as shown in Figure 1.

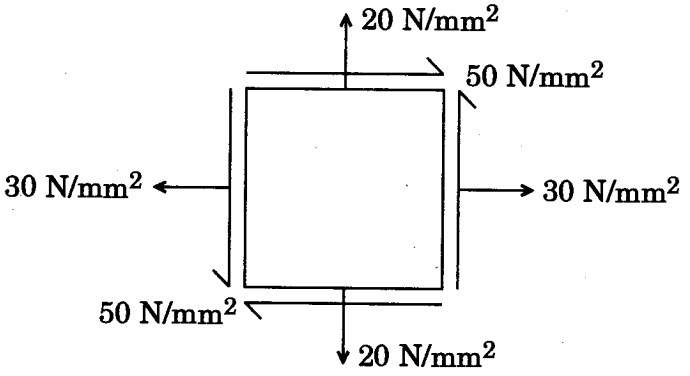

Figure 1

Determine the

(a) maximum and minimum principal stress,

(b) planes on which maximum and minimum principal stresses act, and

(c) magnitude of maximum shearing stress. *14*

4. A simply supported beam AB of span L carrying two point loads each of 'P' are as shown in Figure 2.

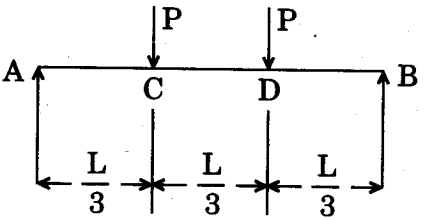

Figure 2

Draw the shear force and bending moment diagram. *14*

5. A rectangular beam 300 mm deep is simply supported over a span of 6 m. What is the maximum value of concentrated load that can be placed at midspan, if the bending stress is limited to 120 N/mm^2 ? Moment of inertia may be taken as 9×10^7 mm^4. *14*

6. A simply supported beam AB of span L carrying a concentrated load W at mid-point C is as shown in Figure 3. Calculate the slope and deflection at the points A, B and C. *14*

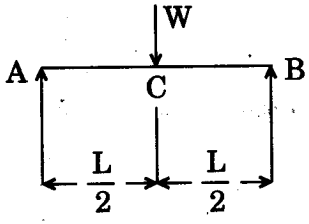

Figure 3

7. Find the maximum torque which can be applied safely to a shaft of 250 mm diameter. The permissible angle of twist is 1° in a length of 10 m and the shear stress is not to exceed 40 N/mm^2. Take modulus of rigidity (C) as 80×10^3 N/mm^2. *14*

8. (a) Write down the formula of equivalent length and Euler's buckling load for a long column when it has

(i) both ends hinged,

(ii) both ends fixed,

(iii) one end fixed and the other hinged, and

(iv) one end fixed and the other free. *4×2=8*

(b) Explain the main causes of bending in the columns. *6*