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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

December, 2015

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 : *7×2=14*

(a) For an isotropic, homogeneous and elastic material obeying Hooke's law, number of independent elastic constants is

(i) 2

(ii) 3

(iii) 9

(iv) 1

(b) The maximum bending moment due to a moving load on a fixed ended beam occurs

(i) at the support

(ii) always at the mid-span

(iii) under the load only

(iv) None of the above

(c) A simply supported beam of length l carries a load varying uniformly from zero at left end to maximum at right end. The maximum bending moment occurs at a distance of

(i) $l/\sqrt{3}$ from left end

(ii) $l/3$ from left end

(iii) $l/\sqrt{3}$ from right end

(iv) $l/3$ from right end

(d) If a shaft of diameter d is subjected to a 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) $\frac{64\,T}{\pi\,d^4}$

(e) Proof resilience is the maximum energy stored at

(i) limit of proportionality

(ii) elastic limit

(iii) plastic limit

(iv) None of the above

(f) Rate of change of bending moment is equal to

(i) shear force

(ii) deflection

(iii) slope

(iv) rate of loading

(g) Two beams, one of circular cross-section and the other of square cross-section, have equal area of cross-section. If subjected to bending

(i) circular section is more economical

(ii) square section is more economical

(iii) both sections are equally strong

(iv) both sections are equally stiff

2. Two parallel walls 6 m apart are stayed together by a steel rod of 20 mm diameter passing through metal plates and nuts at each end. The nuts are tightened, when the rod is at a temperature of 100°C. Determine the stress in the rod, when the temperature falls down to 20°C, if

   (a) the ends do not yield, and

   (b) the ends yield by 1 mm.

   Take $E = 2 \times 10^5$ N/mm^2 and $\alpha = 12 \times 10^{-6}$ K^{-1}. *14*

3. The values of Young's Modulus and Rigidity Modulus of a material are known to be 20·8 GPa and 8 GPa respectively. If a spherical ball of diameter 150 mm made of the material is immersed in water to a depth of 120 metres, find the change in volume of the ball. *14*

4. Derive an expression for the maximum shear stress in a general two-dimensional state of stress and also an expression for the aspect angle of the corresponding plane. *14*

5. A cantilever beam of length 8 m is carrying a u.d.l. of 3 kN/m over a length of 6 m from the free end and 1·5 kN/m on a span of 2 m at a distance of 2 m from the fixed end and a point load of 6 kN at a distance of 1 m from the fixed end. Draw the SFD and BMD for the cantilever beam. *14*

6. A rectangular beam 250 × 400 mm is 8 m long and is simply supported at the ends. It carries a point load of 45 kN at mid-span. Find the maximum bending stresses in the beam. *14*

7. Find the power that can be transmitted by a shaft of 60 mm diameter at 180 rpm, if the permissible shear stress is 85 N/mm^2. *14*

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

   (a) Assumptions in the Euler's Column Theory

   (b) Equivalent Length of a Column

   (c) Resisting Torque

   (d) Slenderness Ratio

   (e) Hooke's Law

   (f) Theory of Simple Bending