No. of Printed Pages : 5

BET-022

Diploma in Civil Engineering / Diploma in Electrical and Mechanical Engineering

Term-End Examination

June, 2011 03213

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 calculator is allowed.*

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

(a) If a material has identical properties in all directions, it is said to be :

(i) homogeneous (ii) isotropic

(iii) elastic (iv) Orthotropic

(b) When a body is subjected to direct tensile stress (σ) in one plane, then normal stress on an oblique plane of body inclined at an angle (θ) to the normal of the plane is equal to :

(i) $\sigma \sin \theta$ (ii) $\sigma \cos \theta$

(iii) $\sigma \sin^2 \theta$ (iv) $\sigma \cos^2 \theta$

(c) 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

(d) When a cantilever is loaded at its free end, maximum compressive stress shall develop at :

(i) bottom fibre

(ii) top fibre

(iii) neutral axis

(iv) centre of gravity

(e) A cantilever beam of span l carries a uniformly distributed load 'w' over its entire span. The maximum slope of the cantilever is :

(i) $\frac{wl^3}{3\,EI}$ (ii) $\frac{wl^2}{4\,EI}$

(iii) $\frac{wl^3}{6\,EI}$ (iv) $\frac{wl^3}{8\,EI}$

(f) A shaft revolving at 'N' rpm, transmits torque (T) in kN-m. The power developed is :

(i) $2\,\pi\,NT$ kW (ii) $\frac{2\pi NT}{30}$kW

(iii) $\frac{2\pi NT}{60}$kW (iv) $\frac{2\pi NT}{120}$kW

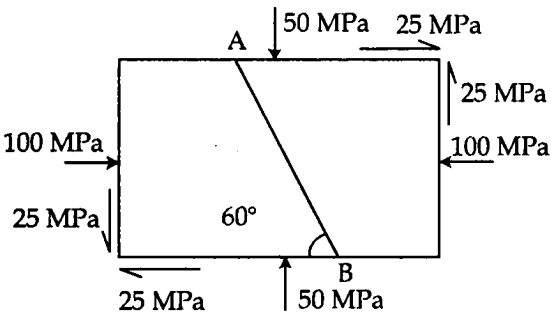
(g) A column of length 'l' is hinged at its both ends. Its equivalent length will be equal to :

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

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

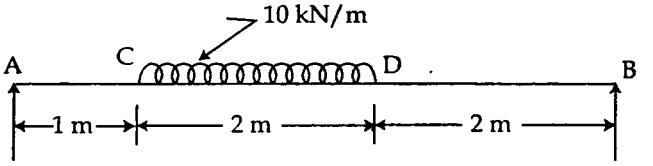
2. A reinforced concrete column 500 mm × 500 mm in cross-section is reinforced with 4 steel bars of 25 mm diameter, one in each corner. The column is carrying a load of 1000 kN. Find the stresses in the concrete and steel bars. Take $E_S = 210$ GPa and $E_C = 14$ GPa. **14**

3. A machine component is subjected to the stresses as shown in figure below : **14**



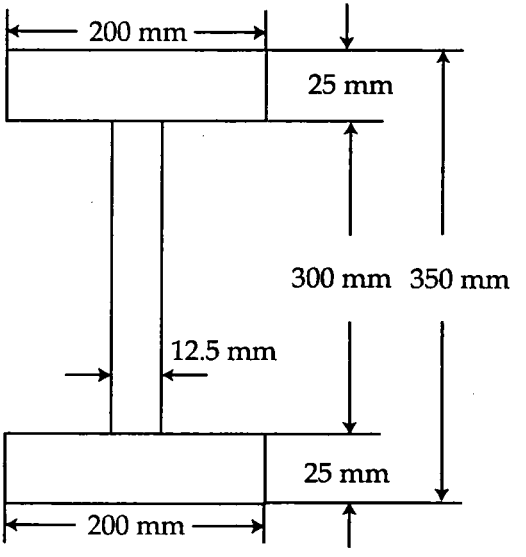
Find the normal and shearing stresses on the section AB inclined at an angle of 60° with (x-x) axis. Also find the resultant stress on the section.

4. A simply supported beam 5 m long is loaded with a uniformly distributed load of 10 kN/m over a length of 2 m as shown in figure. **14**



Draw shear force and bending moment diagrams for the beam, indicating the value of maximum bending moment.

5. An I-section beam 350 mm × 200 mm has a web thickness of 12.5 mm and flange thickness of 25 mm. It carries a shear force of 200 kN at a section, sketch the shear stress distribution diagram across the section. **14**



6. A simply supported beam of 2 m span carries a point load of 20 kN at its mid span. Determine the maximum slope and deflection of the beam. Take flextural rigidity of the beam as 500×10^9 N – mm^2. **14**

7. (a) Define and explain : **4**

   (i) Twisting moment

   (ii) Polar modulus

   (b) 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 allowable twist is 1° for every 20 diameter length of the shaft. Take modulus of rigidity (G) = 80 GPa. **10**

8. A T-section 150 mm × 120 mm × 20 mm is used as a strut of 4 m length which is hinged at its both ends. Calculate the crippling load, if the Young's modulus for the material be 200 GPa. **14**