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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

00603

Term-End Examination

December, 2016

BET-022 : STRENGTH OF MATERIALS

Time : 2 hours | *Maximum Marks : 70*

***Note :** Attempt any **five** questions. All questions carry equal marks. Use of scientific calculator is permitted. Assume any missing data suitably.*

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1. (a) Derive the relationship between Young's modulus of elasticity ('E') and shear modulus of elasticity ('G'). 7

   (b) A compound bar shown in Figure 1 is made up of a rod of area A_1 and modulus E_1; and a tube of equal length of area A_2 and modulus E_2. If a compressive load P is applied to the compound bar, find how the load is shared between the rod and the tube. 7

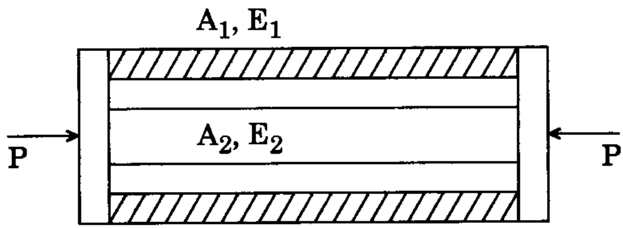

Figure 1

2. (a) Show that the sum of the normal components of the stresses on any two planes at right angles is constant in a material subjected to a two-dimensional stress system. 7

   (b) At a point in a material, there are normal stresses of 30 N/mm^2 and 60 N/mm^2 tensile, together with a shearing stress of 22·5 N/mm^2. Find the value of the principal stresses and the inclination of the principal planes to the direction of 60 N/mm^2 stress. 7

3. A beam, 25 m long, is supported at A and B and loaded as shown in Figure 2. Sketch the Shear Force (S.F.) and Bending Moment (B.M.) diagrams and find the position and magnitude of maximum B.M. and the position of point of contraflexure. 14

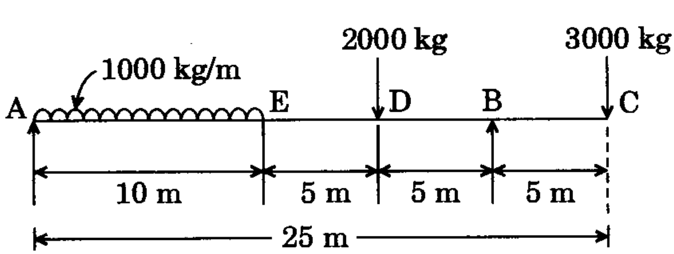

Figure 2

4. Give all the assumptions involved in the theory of pure bending. Also derive the expressions $\frac{\sigma}{y} = \frac{E}{R}$ and $\frac{M}{I} = \frac{\sigma}{y} = \frac{E}{R}$,

where σ, M, I, y, E and R stand for bending stress, bending moment, moment of inertia, distance from neutral axis, Young's modulus of elasticity and radius of curvature respectively. *14*

5. A cantilever, 4 m long, shown in Figure 3 is supported at the free end by a prop, at the same level as the fixed end. A uniformly distributed load of 6000 kg/m is carried along the middle half of the beam, together with a central concentrated load of 5000 kg. Determine the load on the prop and the maximum bending moment. *14*

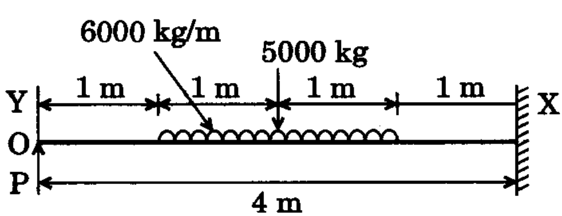

Figure 3

6. (a) Derive an expression for torsional stiffness in terms of G (shear modulus of elasticity), J (polar moment of inertia) and l (length of shaft). *7*

(b) Compare the weights of equal lengths of hollow and solid shafts to transmit a given torque for the same maximum shear stress, if the inside diameter is $\frac{2}{3}$ of the outside. *7*

7. (a) Define the following terms : *3×2=6*

(i) Slenderness Ratio

(ii) Factor of Safety

(iii) Section Modulus

(b) Derive the Euler crippling load for an axially loaded pin-ended (hinged) strut. *8*