Registration No. : | | | | | | | | | | |

Total number of printed pages – 3

B. Tech

PCME 4202

Third Semester (Special / Back) Examination – 2013

MECHANICS OF SOLIDS

BRANCH : AUTO, CIVIL, MECH, MINERAL, MINING

QUESTION CODE : D 219

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) Define Hooke's Law.

   (b) What is Factor of safety ?

   (c) What is Complimentary shear stress ?

   (d) Define hoop stress.

   (e) Define Principal plane.

   (f) What is point of inflection ?

   (g) State the relation between shear force and bending moment.

   (h) State the effective length of Euler's column for different boundary conditions.

   (i) How the value of shear stress is related to the diameter of the shaft under torsion ?

   (j) Explain about solid length of a close coiled spring.

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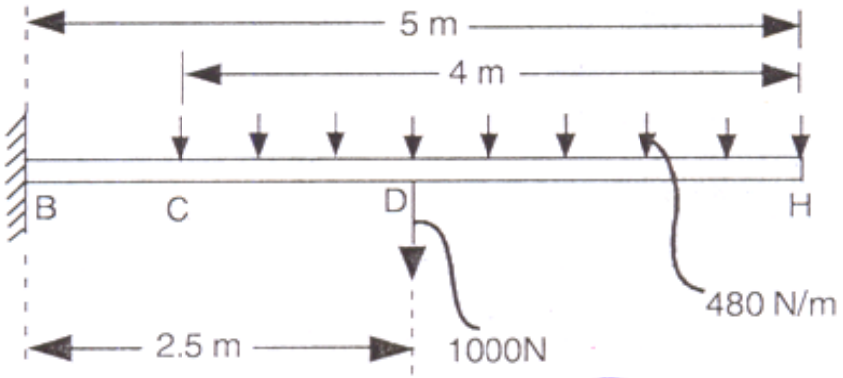
P.T.O.

2. (a) A circular, metal rod of diameter **1** cm is loaded in tension. When the tensile load is **5kN**, the extension of a **25** cm length is measured accurately and found to be **0.0227** cm. Estimate the value of Young's modulus, E, of the metal. 5

(b) A bar of steel, having a rectangular cross-section 7.5 cm by 2.5 cm, carries an axial tensile load of 180 **kN**. Estimate the decrease in the length of the sides of the cross-section if Young's modulus is 200 GN/m^2 and Poisson's ratio is 0.3. 5

3. **A** cantilever 5 m long carries a uniformly distributed vertical load 480 N per metre from C from **H**, and a concentrated vertical load of 1000 N at its midlength, **D**. Construct the shearing force and bending moment diagrams. 10



4. (a) Prove the relation $\frac{\sigma}{y} = \frac{M}{I} = \frac{E}{R}$ in bending of beams. Symbols has their usual meaning. 5

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(b) A simply supported beam of length 1.5m and cross section 15mm × 5mm, fails on applying 600N at the midspan. Determine the maximum magnitude of the uniformly distributed load that can safely applied to this beam. 5

5. **A** steel beam rests on two supports **6** m apart, and carries a uniformly distributed load of **10 kN** per metre run. The second moment of area of the cross-section is **1×10^{-3} m^4** and E = **200 GN/m^2**. Estimate the maximum deflection. 10

6. (a) What is critical load to avoid buckling ? Determine the critical load for a long slender bar clamped at one end, pinned at the other, and loaded by an axial compressive force applied at the pinned end. 5

(b) Calculate the buckling load of a strut fixed at both ends, the cross-section being a square 1 cm by 1 cm, and the length 2 m. Take **E**=200 GN/m^2. 5

7. (a) A steel tube, 3 m long, 3.75 cm diameter, 0.06 cm thick, is twisted by a couple of **50** Nm. Find the maximum shearing stress, the maximum tensile stress, and the angle through which the tube twists. Take G = 80 GN/m^2. 5

(b) A 400 mm long shaft with a diameter of 40mm caries a flywheel weighing 3kN in the mid way. The shaft transmits 12 kW at 200 rpm. Determine the principal stresses. 5

8. (a) Explain about strain energy in torsion. 3

(b) Explain about Mohr's circle for strain. 4

(d) Explain about different forces acting in a close coil spring. 3

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