Code: 9A01101

R9

B.Tech I Year (R09) Supplementary Examinations, November/December 2012

ENGINEERING MECHANICS

(Common to AE, BT, CE and ME)

Time: 3 hours Max Marks: 70

Answer any FIVE questions

All questions carry equal marks

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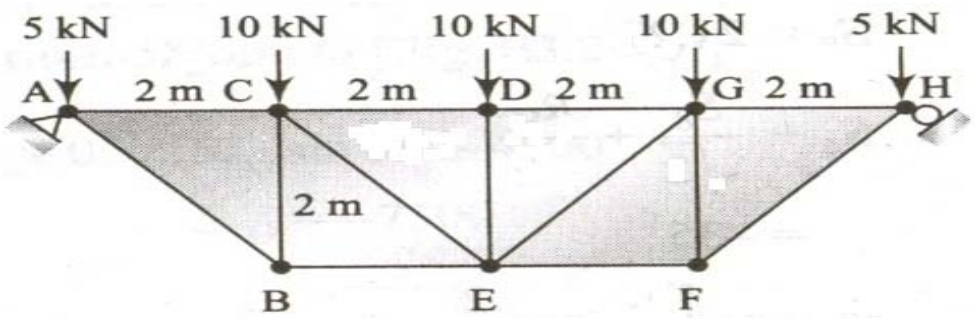
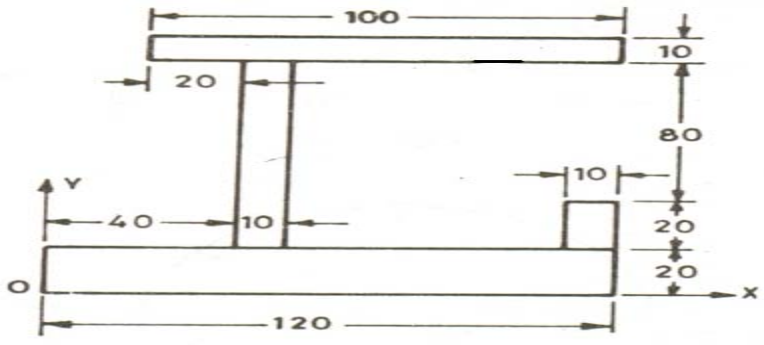
1 Define the following terms:
- (a) Rigid body.
- (b) Principle of transmissibility.
- (c) Triangle law of forces.
- (d) Deformable body.

2 Determine the forces in the members AC, DE and GH of the frame loaded and supported as shown in the below figure.



3 The following particulars refer to a screw jack:
Diameter of screw rod = 62.5 mm.
Length of the handle = 250 mm.
Pitch of the square thread = 12.5 mm.
Coefficient of friction = 0.05.
(i) Find the effort required to lift up a load of 5000 N.
(ii) Find the effort required to lift down a load of 5000 N.

4 Determine the centroid of the built up section in the below figure. Express the coordinates of centroid with respect to x and y axes shown. All the dimensions are shown in mm.



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5 (a) State and prove parallel axis theorem.

(b) Derive the expression to determine moment of inertia of a semicircular area about its diametral axis.

6 (a) A balloon is ascending with a velocity of 20 m/sec above a like a stone is dropped to fall from the balloon and the sound of the splash is heard 6 seconds later. Find the height of the balloon when the stone was dropped. Velocity of sound is 340 m/sec.

(b) The acceleration of a particle in rectilinear motion is defined by the relation $a = 25 - 4S^2$, where 'a' is expressed in m/sec^2 and 'S' is position coordinate in meters. The particle starts with no initial velocity at the position S = 0. Determine

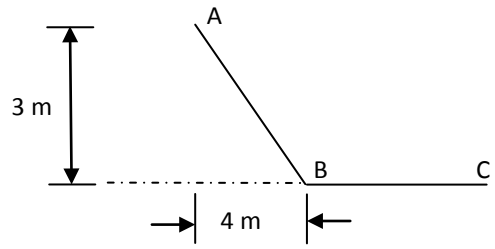
(i) The velocity when S = 3 m.

(ii) The position where the velocity is again zero.

(iii) The position where the velocity is maximum.

7 (a) A homogeneous sphere of radius of a = 100 mm and weight w = 10 N can rotate freely about a diameter. If its starts from rest and gains, with constant acceleration, angular speed N = 180 rpm, in 12 revolutions, find the action moment.

(b) A block starts from rest from 'A'. If the coefficient of the friction between all surfaces of contact is 0.3. Find the distance at which the block stop on the horizontal plane. Assume the magnitude of velocity at the end of slope is same as that at the beginning of the horizontal plane.



8 The central deflection of a simply supported beam with a central point load is given by $\delta = WL^3/48EI$. Where L = 5 m, $E = 2 \times 10^5$ N/mm^2, $I = 1.73 \times 10^{-5}$ m^4. The beam is of uniform cross section with a static load 'W'. Determine

(a) Equivalent spring constant of the beam.

(b) The frequency of vibration of a 60 kg block attached to the center of the beam. Neglect the mass of the beam and assume that the load remains in contact with the beam.

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