**D 34301** (Pages : 4) Name.....

Reg. No.....

# COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION FEBRUARY 2013

EN 04 107 (A)—ENGINEERING MECHANICS (A)

(Common for CE, AI, CH, CE, CS, EE, EC, IT, IC, BM, BT, PT)

[2004 Scheme]

Time : Three Hours Maximum : 100 Marks

*Answer* **all** *questions.*

## Part A

*Each question carries 5 marks.*

1. (a) State (i) Principle of transmissibility and ; (ii) Varignon's theorem.

   (b) A force F has the components $F_x = 200N$, $F_y = -300N$, $F_z = 600$ N. Determine its magnitude 'F' and the angle $\theta_x$ $\theta_y$ and $\theta_z$ it makes with the axes of co-ordinates.

   (c) State Coloumb's Law's of friction.

   (d) What are the principal axes and principle moments of inertia ?

   (e) Find the centroid of a concentric path of 120 mm outer radius and 70 mm inner radius with respect to diametral axis.

   (f) What are the different types of trusses ?

   (g) Derive an expression for finding the work energy equation for a body of mass 'm' Kg moving at an acceleration 'a' $m/sec^2$ for a distance of 'S' $m$.

   (h) Explain the following (i) Free Vibration ; (ii) Torsional vibration.

(8 × 5 = 40 marks)

## Part B

II. (a) Determine the magnitude of a horizontal force P applied at the centre C of a roller of weight 1000 N and radius 100 mm to pull it over a 60 mm curb. Also calculate the magnitude and direction of the least force applied at C that will life the roller over the curb (Figure 1)

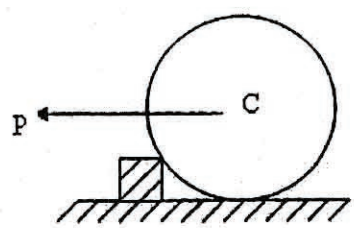



Figure 1

*Or*

(b) A 163 kg crate is applied by three cables as shown in Figure 2. Determine the tension in each cable.

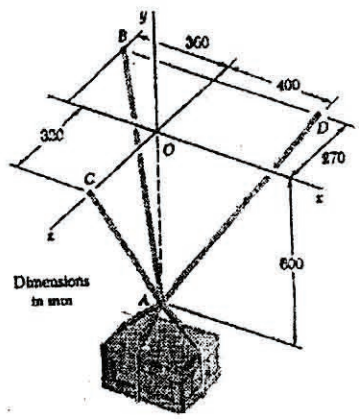



Figure 2

III. (a) A block of weight $W_1$ = 1290 N rests on a horizontal surface and supports another block of weight $W_2$ = 570 N on top of it as shown in Figure 3. Block of weight $W_2$ is attached to a vertical wall by an inclined string AB. Find the Force 'P' applied to the lower block, that will be necessary to cause the slipping to impend. Coefficient of friction between blocks 1 and 2 = 0.25 and coefficient of friction between block 1 and horizontal surface = 0.40.

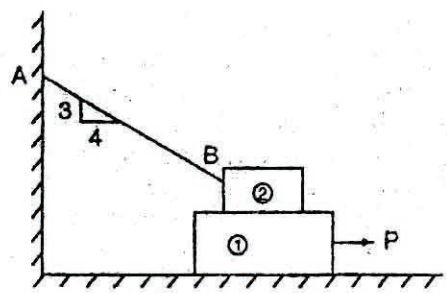



Figure 3

*Or*

(b) Find the moment on inertia of the lamina with a circular hole of 30 mm diameter about the axis AB as shown in Figure 4.

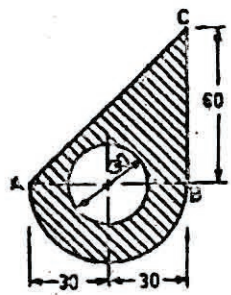
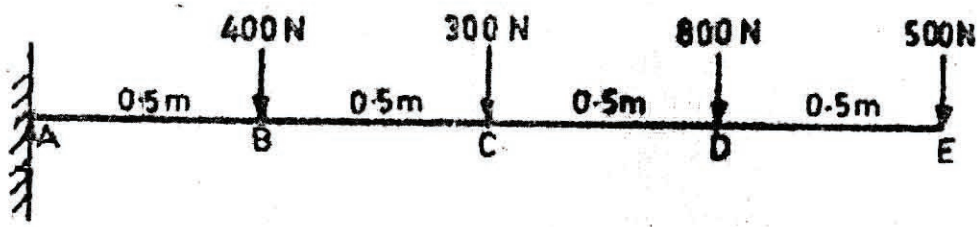



Figure 4

IV.(a) 2. Draw shear force bending moment diagrams for the cantilever beam shown in Figure 5.




*Or*

(b) Find the forces in the various members of the frame shown in Figure 6.

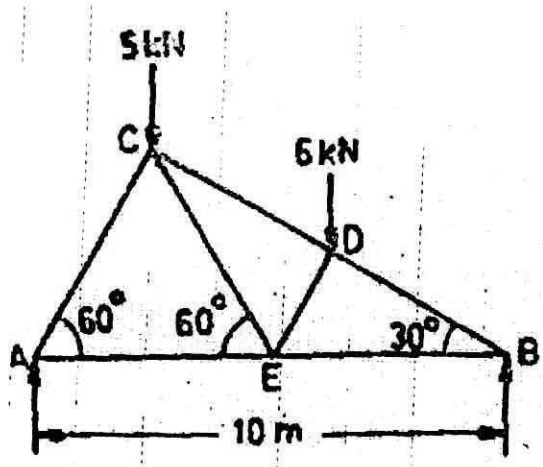



Figure 6

V. (a) (i) A stone is projected vertically upwards from the roof of a building with a velocity of 19.6 m/s and another is dropped downwards from the same point 3s later. If both the stones reaches the ground at the same time determine the height of the building.

(ii) The acceleration of a body starting from rest is given by $a = 15 - 2s$ where '$a$' is in $m/s^2$ and '$s$' in meters. Determine (i) the velocity of the body when it has traveled $4m$ ; (ii) Distance traveled when the body is again at rest.

*Or*

(b) A body weighing 196.2 N slides up a 30° inclined plane under the action of an applied force 300 N acting parallel to the inclined plane. The coefficient of friction is 0.2 The body moves from rest. Determine :

(i) Acceleration of the body.

(ii) Kinetic energy of the body after 4 seconds.

(iii) Work done on the body in 4 seconds.

(iv) Impulse applied in 4 seconds.

(4 × 15 = 60 marks)