C 5810 (Pages : 3) Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2010

EN 2K 107 (A)—ENGINEERING MECHANICS (A)

Common to AI, CH, CE, CS, EE, EC, IT, IC and AR

Time : Three Hours Maximum : 100 Marks

Answer **all** *questions.*

Part A

Each question carries 5 *marks.*

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

2 State Coloumb's laws of friction.

3 State the direction of support reactions in the case of (a) Simply supported ; (b) Hinged end ; and (c) Roller supported end.

4 A force F has the components $F_x = 200$ N, $F_y = -300$ N, $F_z = 600$ N. Determine its magnitude F and the angle θ_x, θ_y and θ_z it makes with the axes of co-ordinates.

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

6 What are principal axes and principal moments of inertia ?

7 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.

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

($8 \times 5 = 40$ marks)

Part B

Each question carries 15 *marks.*

II. (a) Determine the magnitude of a horizontal force P applied at the center 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 (Fig. 1)

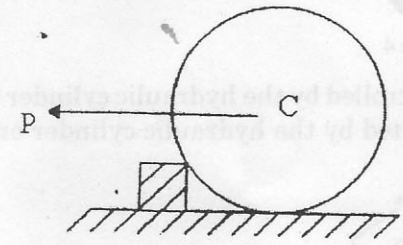

Figure 1

Or

Turn over

(b) 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 Fig. 2. 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.

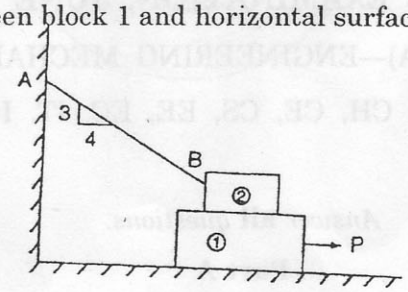

Figure 2

III. (a) Find the forces in the various members of the frame shown in Fig. 3.

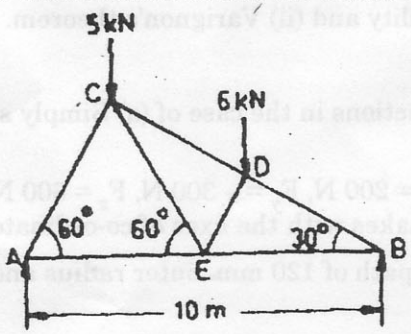

Figure 3 *Or*

(b) A 163 kg. crate is applied by three cables as shown in Fig. 4. Determine the tension in each cable.

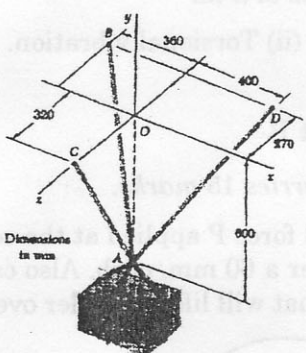

Figure 4

IV. (a) The position of member ABC is controlled by the hydraulic cylinder CD. For the loading shown in Fig. 5. Determine the force exerted by the hydraulic cylinder on pin C when θ = 55°.

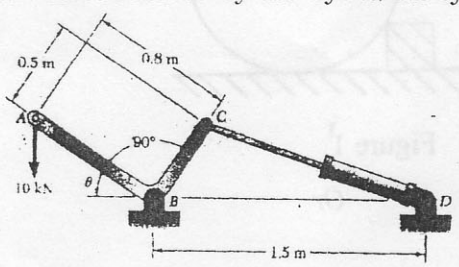

Figure 5

Or

(b) Find the moment of inertia of the lamina with a circular hole of 30 mm. diameter about the axis AB as shown in Fig. 6.

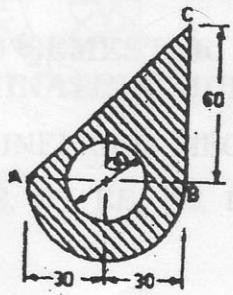

Figure 6

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 metres. Determine (1) the velocity of the body when it has travelled 4 m. ; (2) Distance travelled when the body is again at rest.

Or

(b) A car of mass 1,000 kg. travelling at the rate of 35 m/s clashes into the near of a truck of mass 8,000 kg. travelling in the same direction but with a velocity of 5 m/s. After the collision, the speed of the truck increases to 9 m/sec. Find the velocity of the car after collision. What is the value of the coefficient of restitution ?

(4 × 15 = 60 marks)