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BME-016

B.Tech. MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING) / B.Tech. AEROSPACE ENGINEERING (BTAE)

00052

Term-End Examination

December, 2017

BME-016 : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **five** questions. All questions carry equal marks. Calculators are permitted. Assume missing data, suitably.*

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1. (a) Determine the magnitude and direction of the resultant of the following set of coplanar forces acting on a body : 7

(i) 200 N inclined 30° with East towards North

(ii) 250 N towards North

(iii) 300 N towards North-West

(iv) 350 N inclined at 40° with West towards South

(b) Two smooth spheres P and Q, each of radius 25 cm weighing 500 N each, rest in a horizontal channel having vertical walls (Figure 1). If the distance between the walls is 90 cm, calculate the reactions exerted on the wall and floor at points of contact A, B and C. 7

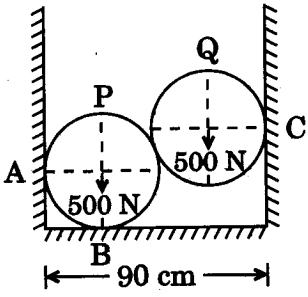

Figure 1

2. (a) Determine the reactions at A and B of a loaded beam as shown in Figure 2. 7

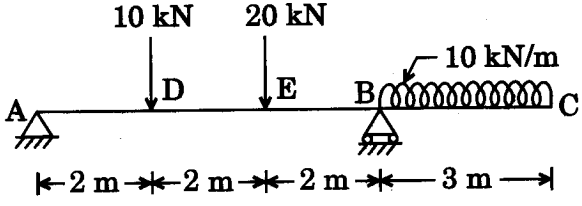

Figure 2

(b) Classify the different types of trusses. What are the conditions of a perfect truss ? Also state the assumptions made for the analysis of a truss. 7

3. A truss is loaded and supported as shown in Figure 3. Determine the reactions at the support A and B. Also determine the forces and natures in the member of CD, CF and FG. *14*

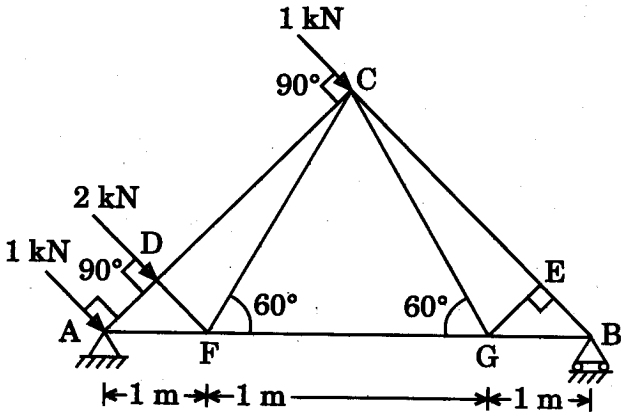

Figure 3

4. (a) How high can a particle rest inside a hollow sphere of radius r if the coefficient of friction be $\frac{1}{\sqrt{3}}$? Justify your answer. *6*

(b) A block of weight W rests on a rough inclined plane of inclination α with the horizontal. The block is subjected to a force P acting horizontal. Derive the following relation for the equilibrium of the block $P = W \tan(\alpha - \phi)$, when the block is at the point of sliding down; where ϕ is the friction angle. *8*

5. (a) A uniform wire has been bent in the form of a quadrant of the arc of a circle of radius r. Locate the position of centroid. 7

(b) Locate the centroid of the area as shown in Figure 4 with respect to the axes indicated in the figure. 7

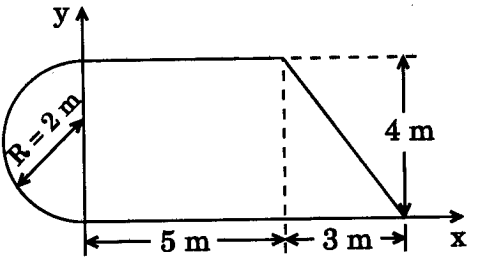

Figure 4

6. (a) A motorist is driving his car at 60 km/hr when he observes that a traffic light 250 m ahead turns red. The traffic light is timed to remain red for 20 seconds before it turns green. The motorist wishes to pass the traffic lights without stopping to wait for it to turn green. Calculate : 7

(i) The required acceleration of the car

(ii) The speed of the car as it passes the traffic light

(b) The acceleration of a particle is expressed as $a = 10 - x$. The particle starts with no initial velocity at the position $x = 0$. Determine

(i) the velocity of the particle when $x = 8$,

(ii) the position of the particle when the velocity is again zero, and

(iii) the velocity of the particle when acceleration becomes zero. 7

7. (a) A wheel accelerates uniformly from rest to a speed of 180 rpm in 0·5 seconds. It then rotates at that speed for 2 seconds before decelerating to rest in 0·3 seconds. Calculate the revolutions made by the wheel during the entire time interval. 7

(b) A body performing simple harmonic motion has amplitude of 5 m and periodic time 4 seconds. The body is to pass between two points which are at a distance of 4 m and 2 m from the centre of force and are on the same side of it. Determine the time the body will take to accomplish this task. 7

8. (a) State and explain D'Alembert's principle. 4

(b) A man weighing 750 N stands on the floor of a lift. Determine the reaction exerted on the floor when (i) the lift moves upward with an acceleration of 2·5 m/sec^2, and (ii) the lift moves downward with an acceleration of 2·5 m/sec^2.

If 900 N reaction is to be exerted on the floor, then with what acceleration should the lift move upward ? Use D'Alembert's principle. *10*
