BACHELOR OF TECHNOLOGY IN MECHANICAL ENGINEERING (COMPUTER INTEGRATED MANUFACTURING)
B.Tech. (AEROSPACE ENGINEERING) (BATE)

Term-End Examination

June, 2013

BME-016 : ENGINEERING MECHANICS

Time : 3 hours *Maximum Marks : 70*

Note : *Answer **any five** questions. Calculator allowed.*

1. (a) An electric light fixture weighing 15N hangs from a point C, by two strings AC and BC. AC is inclined at 60° to the horizontal and BC at 45° to the vertical as shown in figure 1. Using Lami's theorem or otherwise determine the force in the strings AC and BC. 7

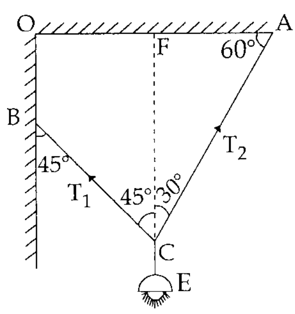

Figure 1

(b) The resultant of forces which are acting at a point O as shown in figure 2 is along y - axis. The magnitude of forces F_1, F_3, and F_4 are 10kN, 20kN and 40kN respectively, the angles made by 10kN , 20kN and 40kN with x - axis are 30°, 90° and 120° respectively. Find the magnitude and direction of force F_2 if resultant is 72 kN. along y axis **7**

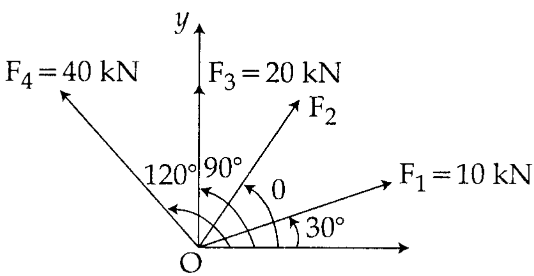

Figure 2

2. (a) Two spheres, each of weight 1000N and of radius 25cm rest in a horizontal channel of width 90cm as shown in figure 3. Find the reactions on the point of contact A, B, and C **7**

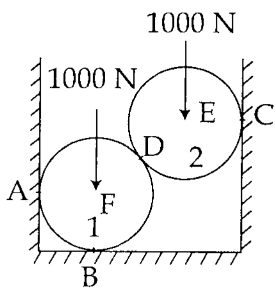

Figure 3

(b) A wire rope is fixed at two points A and D as shown in figure 4. Two weights 20 kN and 30 kN are attached to it at B and C respectively. The weights rest with portions AB and BC inclined at angles 30° and 50° respectively; to the vertical as shown in figure. Find the tension in the wire in segments AB, BC and CD and also the inclination of the segments CD to vertical. 7

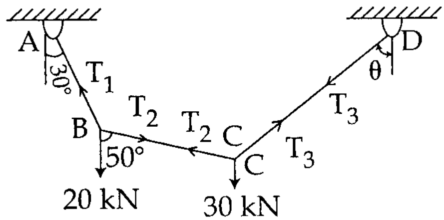

Figure 4

3. (a) A simply supported beam of length 10m carries the uniformly distributed load and two point loads as shown in figure 5. Calculate the reactions R_A and R_B 7

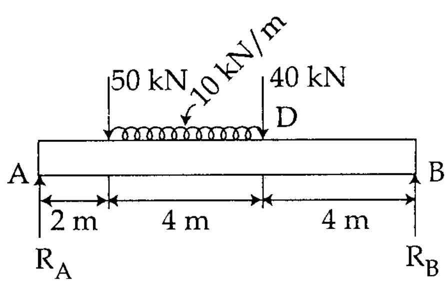

Figure 5

(b) Find moment of inertia of the shaped area shown in figure 6 about the axis AB 7

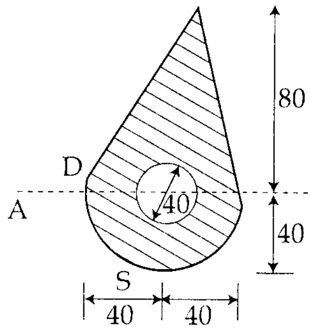

Figure 6

4. (a) Define co-efficient of friction and limiting friction. (b) Block A weighing 15N is a rectangular prism resting on a rough inclined plane as show in figure 7, the block is tied up by a horizontal string which has a tension of 5N. Find. 7

(i) the frictional force on the block.

(ii) the normal reaction of the inclined plane and

(iii) the co-efficient of friction between the surfaces of contact.

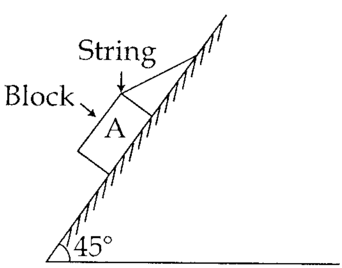

Figure 7

(b) The weight of 14m long bar as shown in figure 8 is 600N and it may be considered to be concentrated at a point 6m from the bottom. It rest against a smooth vertical wall at A and on a rough horizontal floor at B. The co-efficient of static friction between the bar and the floor is 1/3. Establish by calculations if the bar would stand in the 60° position as shown 7

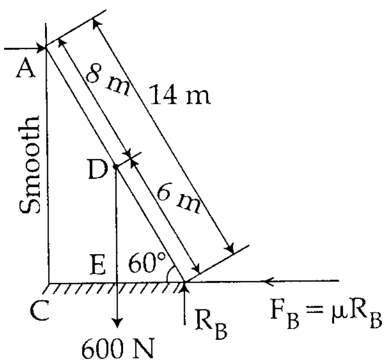

Figure 8

5. (a) A particle moves along a straight line so that its displacement in metre from a fixed point is given by $S = t^3 + 3t^2 + 4t + 5$ 7

Find

(i) Velocity at start and after 4 seconds.

(ii) Acceleration at start and after 4 seconds.

(b) A flywheel is rotating at 200 r.p.m and after 10 seconds it is rotating at 160 r.p.m. If the retardation is uniform, determine number of revolutions made by the flywheel and the time taken by the flywheel before it comes to rest from the speed of 200 r.p.m. **7**

6. (a) A 750N crate rests on a 500N cart. The coefficient of friction between the crate and the cart is 0.3 and between cart and the road is 0.2. If the cart is to be pulled by a force P (fig.9) such that the crate does not slip, determine (a) the maximum allowable magnitude of P and (b) the corresponding acceleration of the cart. **7**

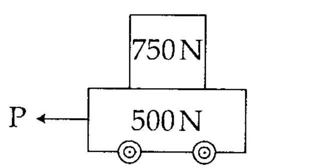

Figure 9

(b) Determine the tension in the string and accelerations of blocks A and B weighing 1500N and 500N connected by an inextensible string as shown in figure 10. Assume pulleys as frictionless and weightless. 7

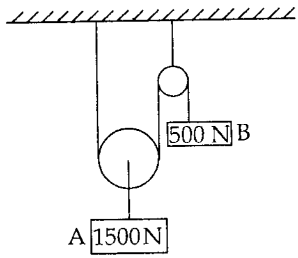

Figure 10

7. (a) Two bodies weighing 300N and 450N are hung to the ends of a rope passing over an ideal pulley as shown in figure 11. How much distance the blocks will move in increasing the velocity of system from 2m/sec to 4m/sec ? How much is the tension in the string ? Use work energy method. 7

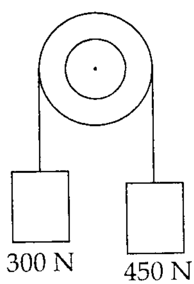

Figure 11

(b) The radius of gyration of a flywheel, which weighs 6kN, is 50cm. If the wheel starts from rest and attains a speed of 200 r.p.m. in 2 minutes,determine the average torque exerted on the flywheel. 7

8. (a) The piston of an engine moves with simple harmonic motion. The crank rotates at 100 r.p.m. and the stroke is 180cm. Find the velocity and acceleration of the piston when it is at a distance of 60cm from the centre. 7

(b) A bullet of mass 100 gm is fired into a freely suspended target of mass 10kg. Due to impact, the bullet gets imbedded in the target and the target with bullet moves with a velocity of 7m/s. Find the velocity of the bullet and the loss of kinetic energy. 7