C 57521 (Pages : 3) Name.....

Reg. No.....

COMBINED FIRST AND SECOND SEMESTER B.TECH. (ENGINEERING) DEGREE EXAMINATION, JUNE 2009

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

(2004 Admissions)

[CE, AI, CH, CE, CS, EE, EC, IT, IC, BM, BT, PT]

Time : Three Hours Maximum : 80 Marks

Part A

Answer **all** *questions.*
Each question carries 5 *marks.*

I. 1 Explain the different types of force system with neat sketch.

2 Explain the conditions of equilibrium for general system of coplanar forces.

3 Define angle of repose.

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

5 Define the term 'support reaction'. Describe the analytical methods for finding out the support reactions of a beam carrying vertical loads only.

6 What is a plane truss? What are the assumptions made in the analysis of plane trusses?

7 State and explain Newton's second law of motion.

8 State and prove the D'Alembert's principle.

(8 × 5 = 40 marks)

II. (a) An automobile is pulled by means of two trucks as shown in Figure 1. If the resultant of the 'two forces acting on the automobile is 25kN being directed along the positive direction of X-axis, determine the angle θ of the cable attached to the track at B such that the force F_B in this cable is minimum. What is the magnitude of force in each cable when this accurs ?

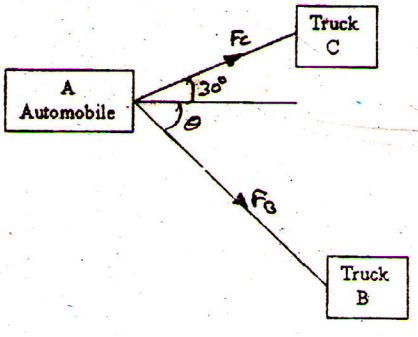

Figure 1

Or

(b) If the tension in wire 'AB' is 75 kN determine the required values of tensions in 'AC' and 'AD', so that the resultant of the three forces applied at 'A' is vertical as shown in Figure 2. Find also the resultant.

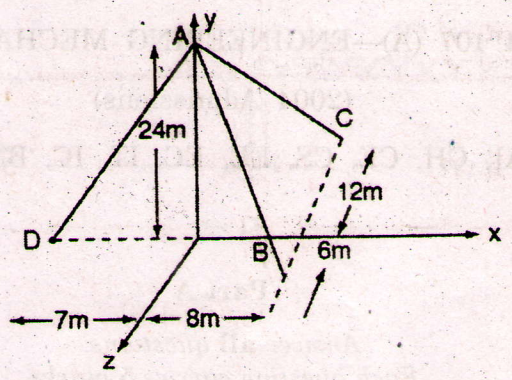

Figure 2

III. (a) An effort of 200 N is required to just move a body up an inclined plane of angle 15°, the forces acting parallel to the plane. If the angle of inclination of the plane is made 20°, the effort required, applied parallel to the plane is found to be 230 N. Find the weight of the body and the coefficient of friction.

Or

(b) Find the mass moment of inertia of the body shown in Figure 3 with respect to X and Y axis. The body is made of alumnium with density 2800 kg/m^3.

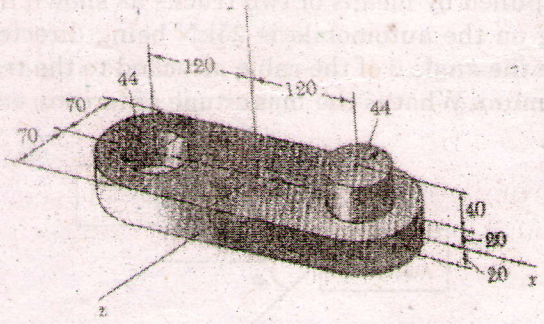

Figure 3

IV. (a) Draw shear force bending moment diagrams for the simply supported beam shown in Figure 4.

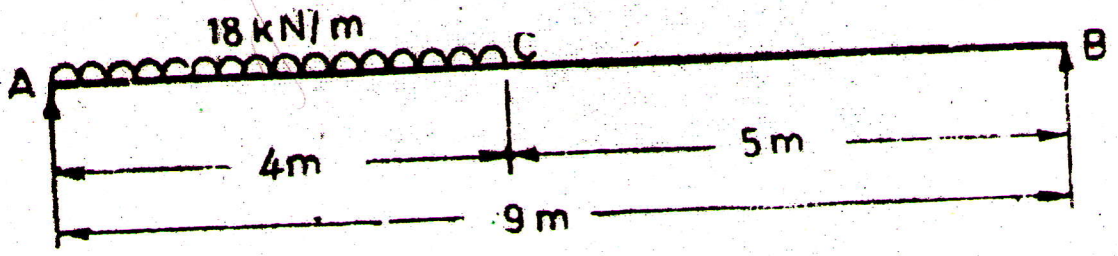

Figure 4

Or

(b) Find the forces in the various members of the frame shown in Figure 5.

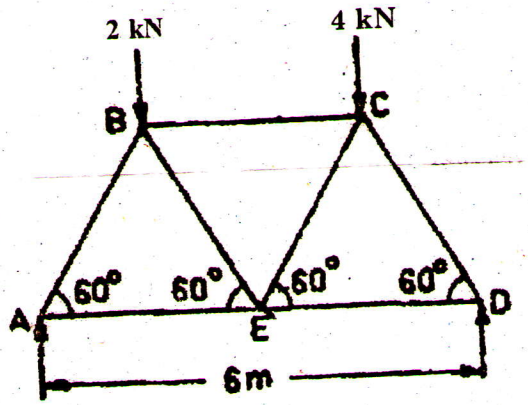

Figure 5

V. (a) Find the power of locomotive drawing a train whose weight is 600 kN up an incline 1 in 100 at a steady speed of 4.5 km/h. Assume frictional resistance to be 8 N per 1000 N

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)