17024(N)

B. Tech 1st Semester Examination

Engineering Mechanics (CBS)

ME-101

Time : 3 Hours   Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note : This question paper carries five sections. Attempt any five questions selecting at least one question each from Section-A, B, C & D. Section-E is compulsory.

SECTION - A

1. (a) How will you represent a space force? Explain how the resultant of space forces is found out.   (6)

    (b) Sketch the different types of supports and the reactions developed in each type. What are the conditions for the equilibrium of a one dimensional rigid body?   (6)

2. (a) State the principle of Transmissibility A space force of magnitude 100 N makes angles of 30° and 70° with the X and Y axis respectively. Write the vector equation for the force. What are the scalar components of the force along the three coordinate axes?   (6)

    (b) Check whether the concurrent, coplanar force system shown in Fig. 1 is in equilibrium. Determine the equilibrant of the given force system, if it is not in equilibrium. .   (6)
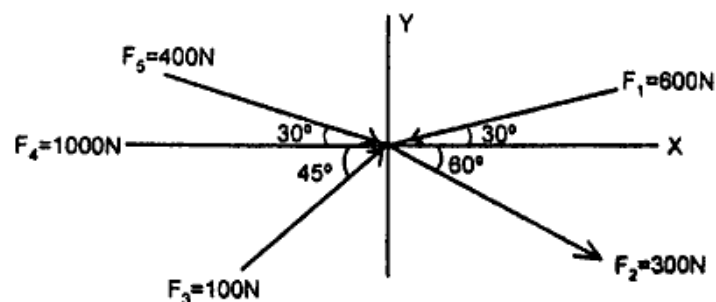

Fig. 1

SECTION - B

3. (a) A body of weight W is placed on a rough inclined plane of inclination α with the horizontal. If μ is the coefficient of friction between the body and the plane, find the minimum and maximum force to be applied horizontally to the plane for equilibrium of the body.   (6)

    (b) Derive an expression for Mass Moment of Inertia of a sphere.   (6)

4. (a) What should be the value of θ in Fig. 2 Which will make the motion of 900 N block down the plane to impend? The coefficient of friction for all contact surfaces is 1/3.   (6)
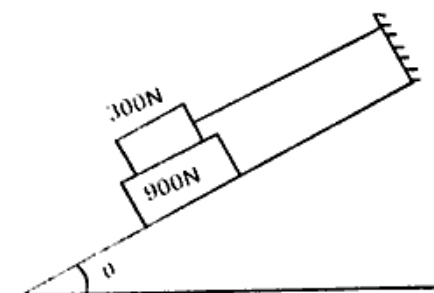

Fig. 2

    (b) Find the moment of inertia of the triangle shown in Fig 3 about its centroidal XX and YY axes.   (6)
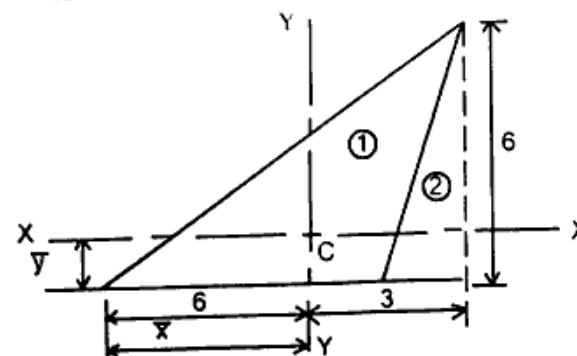

Fig. 3

SECTION - C

5. (a) What is a Frame? Define and explain the terms. Perfect frame, Imperfect frame, Deficient frame and a redundant frame with examples. What are the assumptions made in finding out the forces in a frame?   (6)

[P.T.O.]

(b) A simply supported beam of length 10 m, carries the uniformly distributed load and two point loads as shown in Fig. 4. Draw the S.F. and B.M. diagrams for the beam. Also calculate the maximum bending moment. (6)
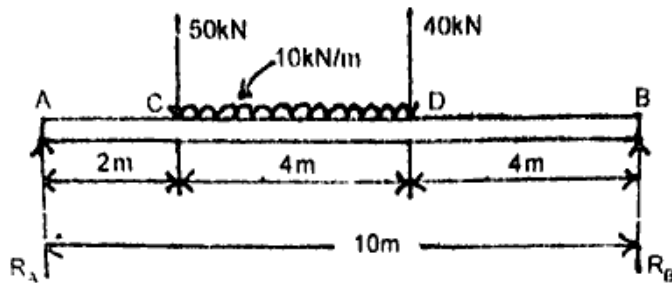

Fig. 4

6. (a) Find the forces in the members AB, AC of the truss shown in Fig. 5. Using method of section. (6)
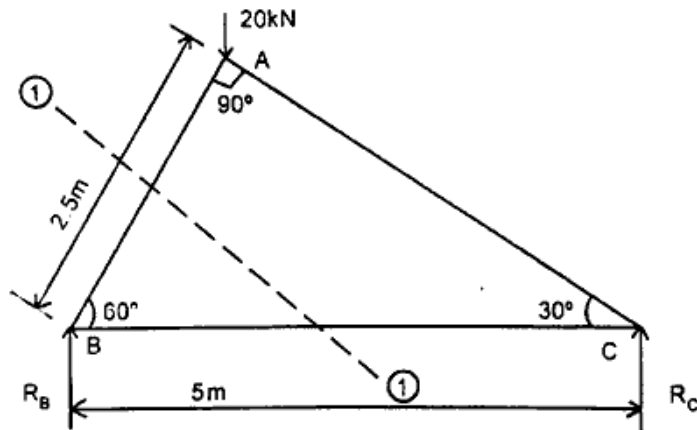

Fig. 5

(b) Derive the relation and draw shear force and bending moment diagram for a simply supported beam carrying a uniformly varying load from zero at one end to w per unit length at the other end. (6)

SECTION - D

7. (a) An automobile travels 240 m in 30 seconds while being accelerated at a constant rate of 0.2 m/s². Determine (i) the initial velocity (ii) its final velocity (iii) distance travelled in every 10 seconds (d) distance travelled in the 10th second. (6)

(b) A 60 N block is released from rest on an inclined plane which is making an angle of 30° with the horizontal. The block starts from A and slides down a distance of 1.5m striking a spring of stiffness

10 kN/m Fig. 6. The coefficient of friction between the inclined plane and the block is 0.30. Find (a) the amount the spring gets compressed (b) distance the block will rebound up the plane from the compressed position. (6)
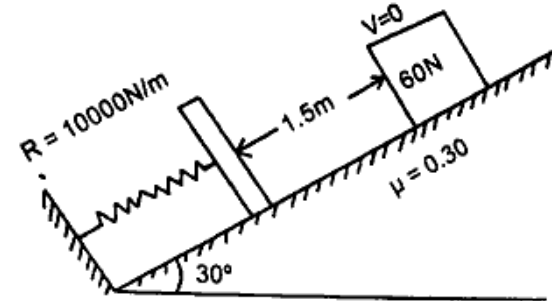

Fig. 6

8. (a) A small grinding wheel is attached to the shaft of an electric motor which has a rated speed of 3600 rpm. When the power is turned on, the unit reaches its rated speed in 5 s and when the power is turned off, the unit comes to rest in 70 s. Assuming uniformly accelerated motion, find the number of revolutions that the motor executes (i) in reaching its rated speed (b) to come to rest. https://www.hptuonline.com (6)

(b) A bullet weighing 1 N is moving with a velocity of 300 m/s and hits a wooden block of 60 N moving away at 20 m/s and gets embedded in it. Find the velocity of the bullet after impact and amount of kinetic energy lost. (6)

SECTION - E (Compulsory Question)

9. Write short answers of the following:

(a) State Newton's Law which explains that a force always occurs in pairs.

(b) State the conditions under which a force does not have moment about an axis.

(c) State the seven laws of friction.

(d) A plane area has two lines of symmetry. What can you say about its centroid?

(e) Distinguish between plane truss and space truss.

(f) What are the various types of beams, loads and supports?

(g) What do you mean by relative distance, relative velocity and resultant velocity?

(h) State the principle of impulse-momentum for a rigid body. (1½×8=12)