[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2068)

18026(M)

B. Tech 2nd Semester Examination

Engineering Mechanics (CBS)

ME-101

Time : 3 Hours **Max. Marks : 60**

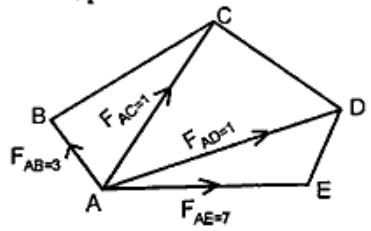
The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

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) Classify various types of forces with neat sketches. What is a free body diagram? Define resultant and equilibriant. (6)

   (b) Forces 7kN, 1kN, 1kN and 3kN act at one of the angular points of a regular pentagon towards four other angular points taken in order. Obtain the resultant of this force system. What is the direction? (6)



2. (a) Determine the resultant of the general coplanar force system shown in Fig. 1.1. (6)

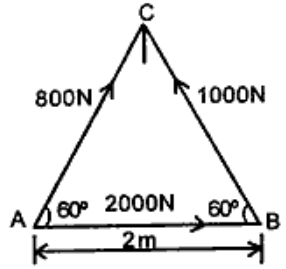


Fig. 1.1

(b) A body is acted upon by only a concurrent coplanar force system. Is it possible for the force system to produce a rotation of the body? Give reasons. State the conditions of equilibrium of a concurrent coplanar force system in terms of moments only. (6)

SECTION - B

3. (a) A block of stone weighing 50kN rests on a horizontal floor. If the coefficient of friction between the floor and the block is 0.3 and if a man pulls the block through a string which makes an angle α with the horizontal, find for what value of the force necessary to move the block will be minimum. Find the force also. (6)

   (b) Determine the centroid of the area of the sector of a circle of radius "R", and subtended angle "2α" as shown in Fig. 1.2. (6)

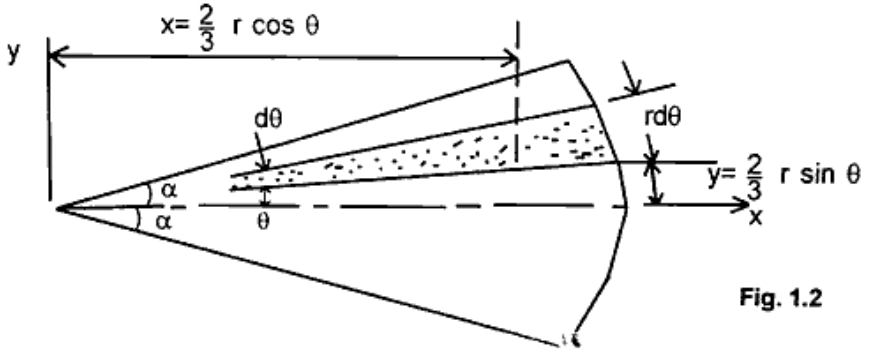


Fig. 1.2

4. (a) In a simple machine whose velocity ratio is 30, a load of 2400 N is lifted by an effort of 150 N and a load of 3000N is lifted by an effort of 180N. Find the law of machine and calculate the load that could be lifted by a force of 200N. Calculate also: (i) The amount of effort wasted in overcoming the friction; (ii) Mechanical advantage, and (iii) The efficiency. (6)

   (b) Derive an expression for Mass Moment of Inertia of a right circular cone of base Radius R, Height H and Mass M about its axis. (6)

SECTION - C

5. (a) Distinguish between plane truss and space truss. Explain the principles involved in (a) method of joints (b) method of sections in the analysis of trusses. (6)

   (b) Draw the shear force and bending moment diagram for a simply supported beam of length 9m and carrying a uniformly distributed load of 10kN/m for a distance of 6m from the left end. Also calculate the maximum B.M. on the section. (6)

[P.T.O.]

6. (a) Using the method of joints, determine the forces in all members of the truss shown in Fig. 1.3 and indicate the magnitude and nature of the forces. All members are 2m long. (6)

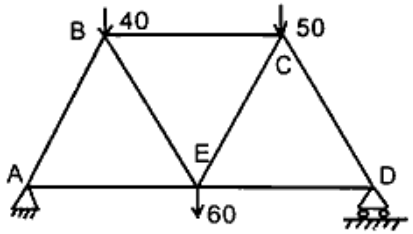


Fig. 1.3

(b) For the beam loaded as shown in Fig. 1.4 calculate the value of UDL w so that bending moment at C is 50 kNm. Draw the shear force and bending moment diagrams for this beam for the calculated value of w. Locate the point of contraflexure, if any. (6)

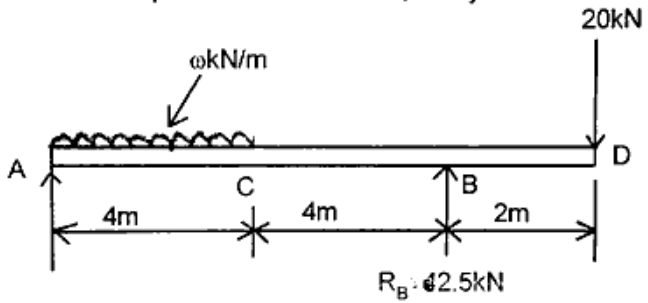


Fig. 1.4

SECTION - D

7. (a) A cylinder of radius 2 m rolls without slipping along a horizontal plane as shown in Fig. 1.5. Find the velocity of the points A, B and D on the circumference of the cylinder. The centre C has a uniform velocity of 10 m/s. (6)

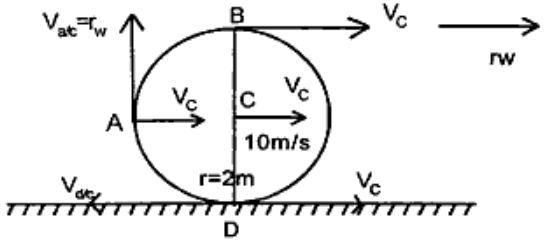


Fig. 1.5

(b) A man of mass 60 kg stands at one end of 6 m long floating boat of mass 300 kg as shown in Fig. 1.6. If the man starts walking to other end of the boat at 2 m/s, find (i) absolute velocity of the boat, (ii) distance of shifting of the boat, (iii) velocity of the boat when man

reaches other end of the boat and (iv) velocity of the boat if man falls in the water while walking. (6)

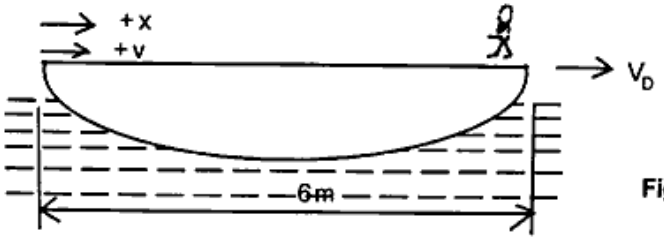


Fig. 1.6

8. (a) A cylinder of weight W and radius r is suspended from a string that is wound round its circumference as shown in Fig. 1.7. If the cylinder is allowed to fall freely, find the acceleration of its mass centre C and the tension in the string. (6)

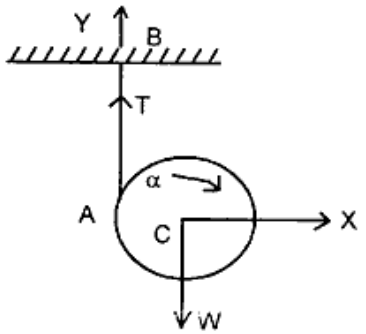


Fig. 1.7

(b) Write equations of motion for rectangular components, tangential and normal components, radial and transverse components. State and explain D Alembert's principle. Why it is called principle of dynamic equilibrium? (6)

SECTION - E (Compulsory Question)

9. Write short answers on the following:
   (a) State the principle of Transmissibility.
   (b) Define the term "Free Body Diagram". What is the purpose of drawing a Free Body Diagram?
   (c) What do you mean by Angle of Friction and Cone of Friction?
   (d) Distinguish between centre of gravity and centroid.
   (e) What are the assumptions made for the analysis of a perfect and plane truss?
   (f) What are different types of beams and different types of loads acting on beams?
   (g) What do you mean by plane motion of rigid bodies? Give examples.
   (h) Define Impulse and momentum. (1½×8=12)