

B.Tech. (C) / I

A

Paper (ECE - 106)
ENGINEERING MECHANICS

Time : 3 hours

Maximum Marks : 70

(Write your Roll No. on the top immediately on receipt of this question paper.)

Attempt **four** questions in all.
Question Number 1 is compulsory.
Answer any **three** from remaining.

1. a) Enumerate the characteristics of a force.
b) Differentiate between statics, kinetic and kinematics.
c) Explain the principle of transmissibility of forces.
d) Define the term resultant of a force system.
e) Define the term free body diagram and state the importance of drawing such a diagram. 5 x 2 = 10

2. a) A string ABC of length 50cm is tied to two points A and C at the same level. A smooth ring of weight 500N which can slide along the string is at B, 30cm away from A along the string and pulled by a horizontal force P as shown in fig (1). If point B is 15cm below the level of AC, determine the magnitude of force P. It may be presumed that tensions in the string on both sides of B are same. 10
b) A roller of weight 500N rests on a smooth inclined plane and is kept free from rolling down by a string as shown in fig (2). Work out tension in the string and reaction at the point of contact B. 10

2. a) Determine reactions at A and B for the beam loaded and supported as shown in fig (3). 10
b) A weightless bar AB is placed in horizontal position on smooth inclines as shown in fig (4). Calculate the distance υ at which the 100N load be placed from end B so that the bar remains horizontal. 10

3. a) Forces equal to P, 2P, 3P and 4P act along the sides AB, BC, CD and DA of a square ABCD. Find the magnitude, direction and line of action of the resultant. Side of square is a. See fig. (5) 10
b) A rigid bar is subjected to a system of Parallel forces as shown in fig (6). Reduce this system to
(i) a single force
(ii) a single force - moment system at A
(iii) a single force - moment system at B. 10

4. a) Determine the magnitude and nature of forces in the various members of the triangular truss loaded and supported as shown in fig (7). 10

- b) Locate the Centroid of the area shown in fig (8). All dimensions are in mm. 10
- 5 a) A block weighing 600N has been subjected to the load system as shown in fig (9). Work out the frictional force for the block and state whether it is in equilibrium or in motion. What additional force needs to be added to 120N force so that the block just moves to the left? 10
- b) An effort of 50N is required by a machine to lift a load of 500N. The distance moved by the effort is 60cm and the corresponding load movement is 6cm. Make calculations for the mechanical advantage, velocity ratio and efficiency of the machine. 10
- 6 a) An elevator of mass 600kg is ascending with an acceleration of 2.5m/sec^2 . During the ascent, its operator who weighs 700N is standing on the scales placed on the floor of the elevator. Calculate the scale reading and total tension in the cables of elevator during this motion. 10
- b) A train weighing $2 \times 10^6\text{N}$ starts from rest with an acceleration of 0.8m/sec^2 and acquires a speed of 90km/hr. Determine the kinetic energy corresponding to final speed and the average power required. Subsequently the power is shut off and the train is subjected to a retarding force equal to 8% of the weight of train. Calculate the distance the train will travel before coming to rest. 10

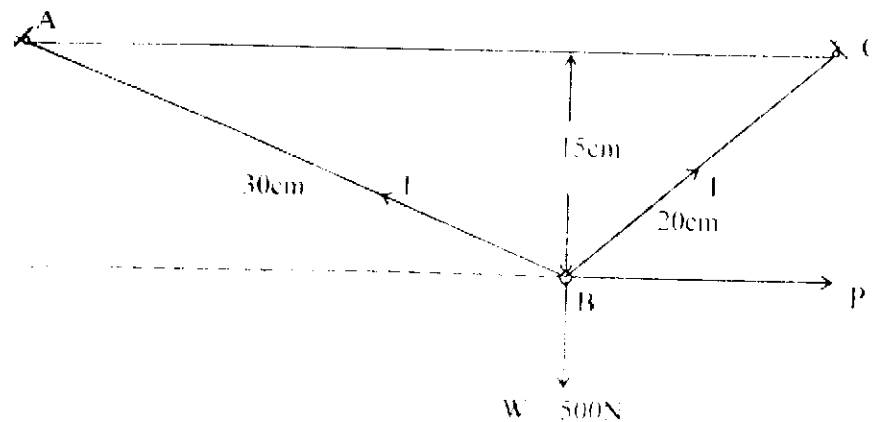


Fig [1]

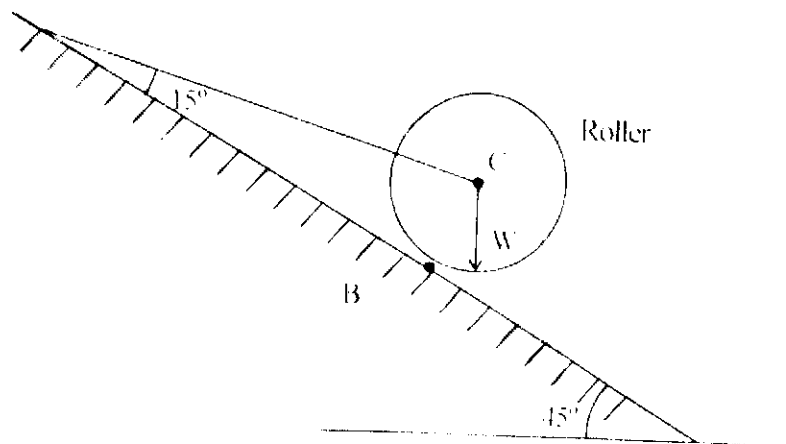


Fig [2]

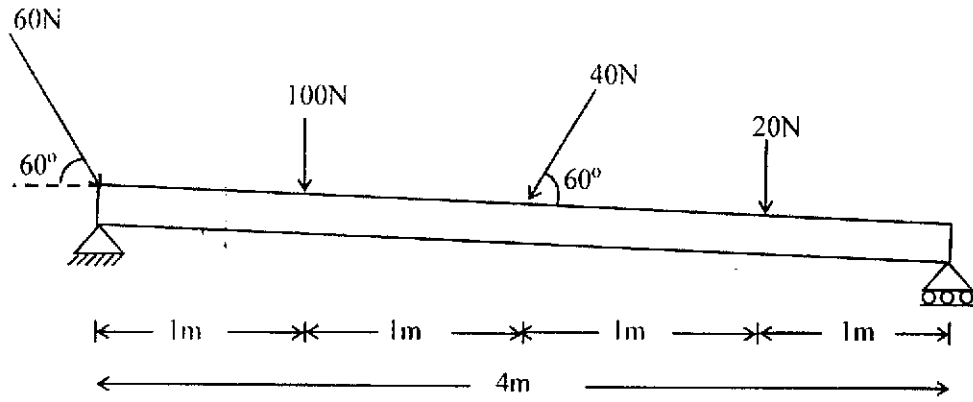


Fig [3]

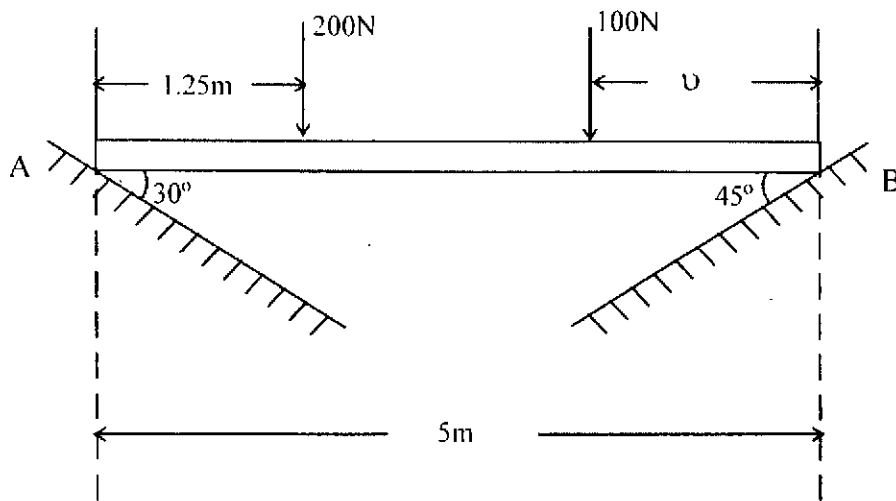


Fig [4]

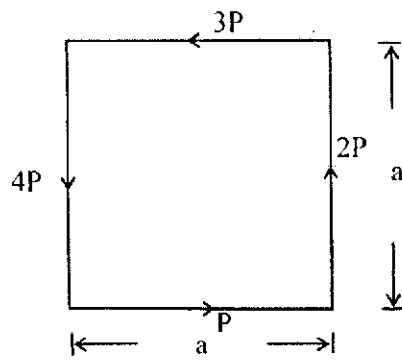


Fig [5]

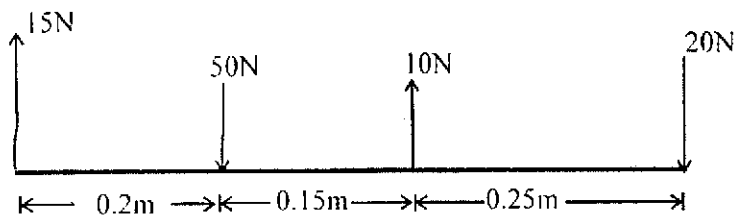


Fig [6]

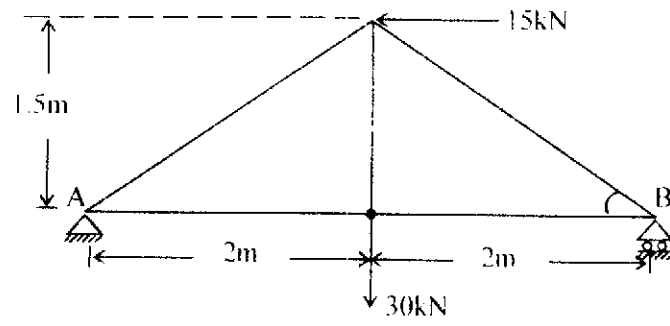


Fig [7]

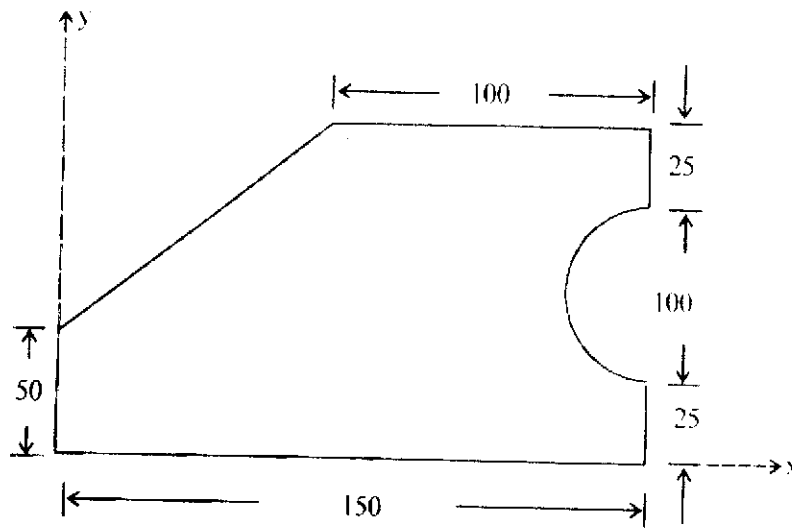


Fig [8]

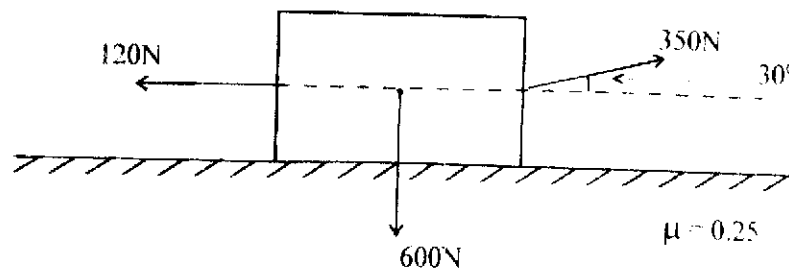


Fig [9]