Code No: 182AA

R22

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year II Semester Examinations, February - 2025
APPLIED MECHANICS
(Civil Engineering)

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

Note: This question paper contains two parts A and B.
i) **Part- A** for 10 marks, ii) **Part - B** for 50 marks.

- Part-A is a compulsory question which consists of ten sub-questions from all units carrying equal marks.
- Part-B consists of **ten questions** (numbered from 2 to 11) **carrying 10 marks each**. From each unit, there are two questions and the student should answer one of them. Hence, the student should answer five questions from Part-B.

PART- A

(10 Marks)

1.a)	What is the principle of transmissibility of a force?	[1]
b)	What is the significance of equilibrium in the context of engineering mechanics?	[1]
c)	What is the difference between static friction and kinetic friction?	[1]
d)	What is the difference between a centroid and a moment of inertia?	[1]
e)	Define polar moment of inertia.	[1]
f)	Define the parallel-axis theorem.	[1]
g)	What is the relationship between position, velocity, and acceleration in particle motion?	[1]
h)	Define rectilinear motion and provide an example.	[1]
i)	State the work-energy principle.	[1]
j)	Define impact force in the context of impulse-momentum.	[1]

PART - B

(50 Marks)

2.a) Find the magnitude and direction of the resultant force. Also find the position of the resultant force from point P of the bar PS (Figure 1).

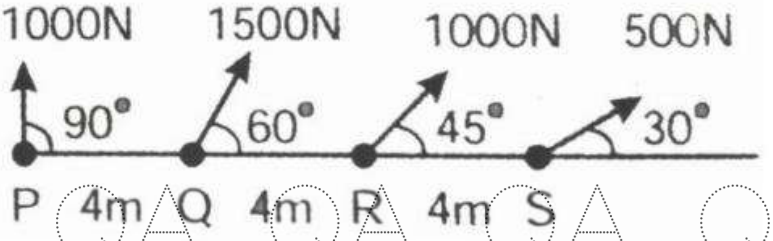

Figure: 1

b) Refer to figure 2. If the maximum allowable strength for each cable is 10.5 kN, determine the permissible weight of the homogeneous circular plate of diameter 4m. [5+5]

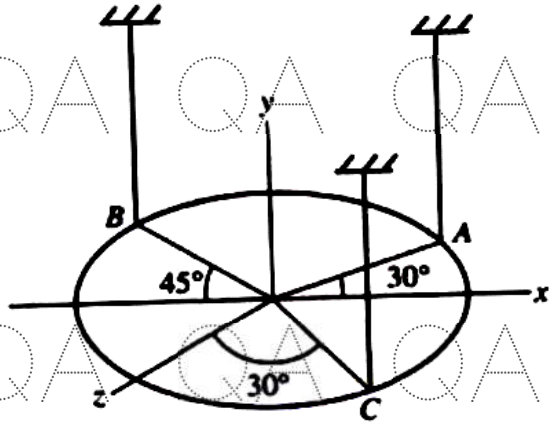

Figure: 2

OR

3.a) A traffic signal of mass 50kg is hung with the help of two strings, as shown in figure 3 below. Find the forces induced in both the strings.

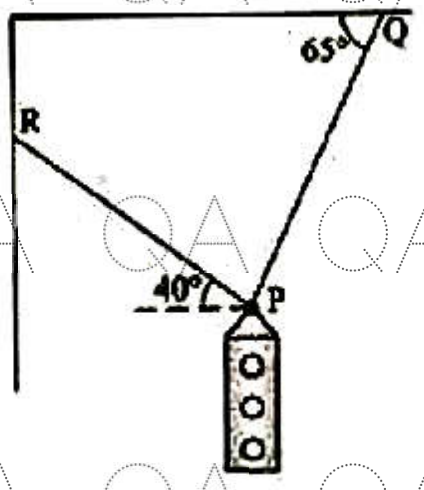

Figure 3

b) Three bars lying in one plane hinged at their ends are shown in figure 4. They are subjected to force P and Q applied at B and C. If P = 100 N, determine the value of force a necessary to keep the system of bars in equilibrium. [5+5]

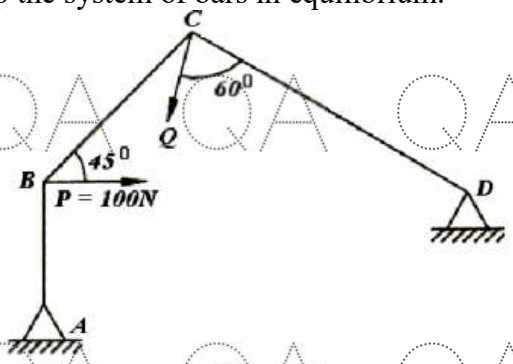

Figure 4

4. A 10 N force is pushing a 40 N block down an inclined plane of inclination 40^0. The coefficient of static friction between the block and the plane is 0.75, and the coefficient of kinetic friction is 0.65. Will the block slide on the plane? If it does, will it slide up or down the plane? What is the friction force between the block and the plane? [10]

OR

5.a) A block weighing 100 N is resting on a rough plane inclined 20^0 to the horizontal. It is acted upon by a force of 50N directed upward at angle of 14^0 above the plane. Determine the friction. If the block is about to move up the plane, determine the co-efficient of friction.

b) A 108 N block is held on a 400 incline by a bar attached to a 150 N block on a horizontal plane Figure 5. The bar which is fastened by smooth pins at each end, is inclined 20^0 to the horizontal. The co-efficient of friction between each block and its plane is 0.325. For what horizontal force P, applied to 150 N block will motion to the right be impending? [5+5]

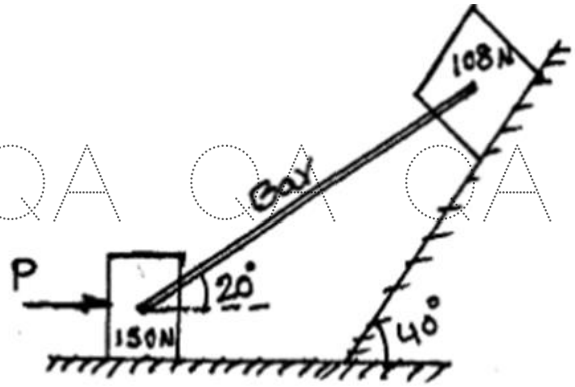

Figure 5

6.a) Show that the moment of inertia of a thin circular ring of mass 'M' and mean radius 'R' with respect to its geometric axis is MR^2.

b) Find out the mass moment of inertia of a right circular cone of base radius 'R' and mass 'M' about the axis of the cone. [5+5]

OR

7.a) Find the moment of inertia of the area shown shaded in the following figure 6 about edge AB.

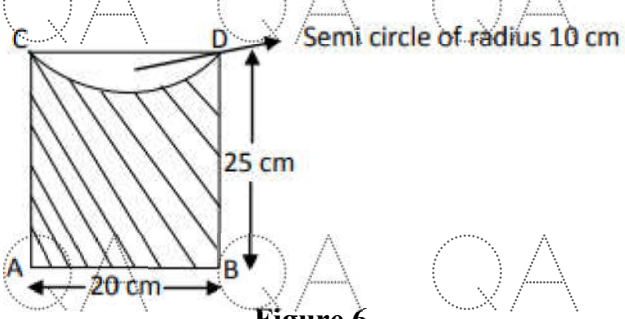

Figure 6

b) A rectangular parallelopiped has the following dimensions. Length along x-axis = 'l' Height along y-axis = 'a' breadth along z-axis = 'b' Density of the material is 'w'. Determine the mass moment of inertia of the parallelopiped about the centroidal axes. [5+5]

8.a) A particle under a constant deceleration is moving in a straight line and covers a distance of 20 m in first two seconds and 40 m in the next 5 seconds. Calculate the distance it covers in the subsequent 3 seconds and the total distance covered, before it comes to rest.

b) Deduce the general expression to determine the maximum height and horizontal range of projectile. [5+5]

OR

9.a) An electric train which starts from one station is uniformly accelerated for the first 10 seconds during which period it covers 150 m. It then runs with constant speed until it is finally retarded uniformly in the last 40 m. Calculate the maximum speed and the time taken over the journey to the next stopping station which is 600 m from the previous station.

b) A shot is fired with a bullet with an initial velocity of 20m/s from a point 10m in front of a vertical wall 5m. Find the angle of projection with the horizontal to enable the shot to just clear the wall. Also find the range of shot where the bullet falls on the ground.[5+5]

10.a) Write short notes on the following:
(i) work-energy method
(ii) Equations of plane motion
(iii) Fixed axis rotation

b) An automobile moving with a uniform velocity of 40Kmph is accelerated by increasing the traction force by 20%. If the resistance to motion is constant, find the distance traveled before it acquires 50Kmph. Use work-energy method. [5+5]

OR

11.a) A simply supported beam at the ends, 5m span carries a load of 15kN at a distance of 2m from one end. Determine the end reaction using the principle of virtual work(Figure 7).

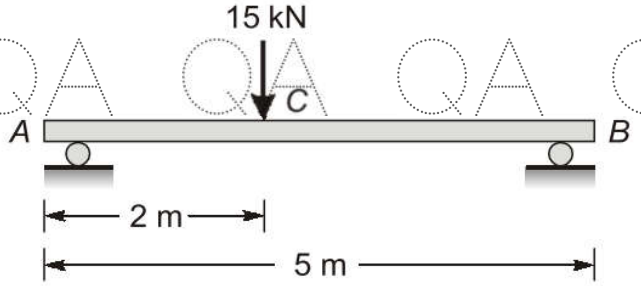

Figure 7

b) A ladder AB of weight 'W' and length 'l' is held in equilibrium by a horizontal force 'P' as shown in the figure 8. Assuming the ladder to be idealized as a homogeneous rigid bar and the surfaces to be smooth, Find the relation between 'P' and 'W' using Principle of virtual work. [5+5]

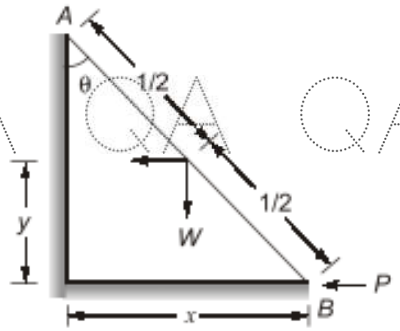

Figure 8

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