20/5/25 AN

Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, APRIL / MAY 2025

DEPARTMENT OF MECHANICAL ENGINEERING

II Semester

GE5152 – Engineering Mechanics

(Common to all branches)

(Regulation 2019)

FN

[Note: All the figures should be referred readily below the respective questions]

Time:3hrs. Max.Marks: 100

CO1 Applying the various methods to determine the resultant forces and its equilibrium acting ona particle in 2D and 3D.

CO2 Applying the concept of reaction forces (non-concurrent coplanar and noncoplanar forces) and moment of various support systems with rigid bodies in 2D and 3D in equilibrium. Reducing the force, moment, and couple to an equivalent force - couple system acting on rigid bodies in 2D and 3D.

CO3 Applying the concepts of locating centroids/center of gravity of various sections / volumes and to find out area moments of inertia for the sections and mass moment of inertia of solids

CO4 Applying the concepts of frictional forces at the contact surfaces of various engineering systems.

CO5 Applying the various methods of evaluating kinetic and kinematic parameters of the rigid bodies subjected to concurrent coplanar forces.

BL – Bloom's Taxonomy Levels

(L1- Remembering, L2- Understanding, L3- Applying, L4- Analysing, L5- Evaluating, L6- Creating)

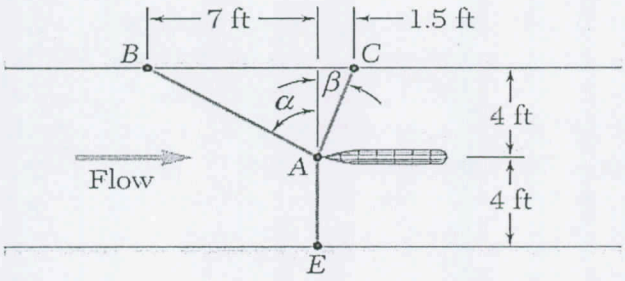
PART- A (10 x 2 = 20 Marks)

(Answer all the Questions)

Q.No	Questions	Marks	CO	BL
1	Define the polygon law with suitable example.	2	1	L2
2	Find the unit vector between the points represented in Cartesian coordinates as (0, 1, -1) mm and (1.5, -2, 3) mm.	2	1	L2
3	Write down the significances of Varignon's theorem.	2	2	L1
4	Represent the vector form of Moment acting at two points A and B in space with respect to the Force vector and distance between those points.	2	2	L2
5	State the parallel axis theorem.	2	3	L1
6	At what geometrical condition, the value product of inertia is taken as zero? Give an example.	2	3	L2
7	Pen down the friction law corresponds to two sliding bodies placed one on another in surface contact lies on an inclined wall.	2	4	L2
8	Draw the free body diagram of a ladder such that one of its ends is on the floor and other end is on the smooth wall.	2	4	L2
9	A particle moving with an angular velocity of 5 rad/s around a fixed axis at a distance of 2 m from the axis. Find its linear velocity.	2	5	L2
10	State the law of conservation of momentum. Write its expression.	2	5	L1

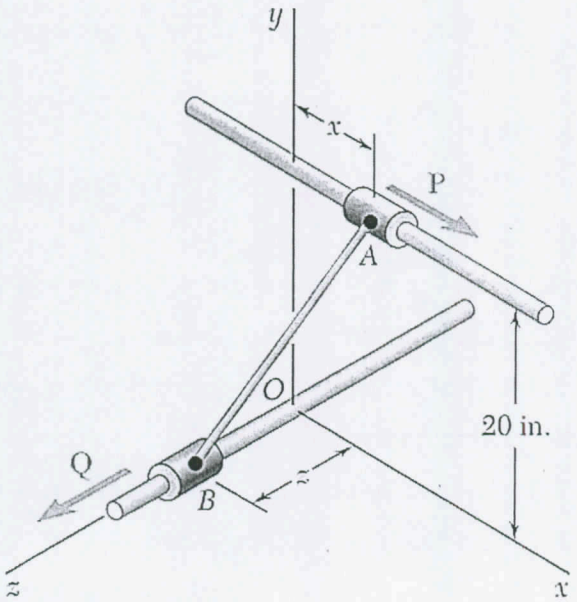
PART- B (5 x 13 = 65 Marks)

Q.No	Questions	Marks	CO	BL
11 (a) (i)	As part of the design of a new sailboat, it is desired to determine the drag force which may be expected at a given speed. To do so, a model of the proposed hull is placed in a test channel and three cables are used to keep its bow on the centre line of the channel. Dynamometer readings indicate that for a given speed, the tension is 40 lb. in cable AB and 60 lb. in cable AE. Determine the drag force exerted on the hull and the tension in cable AC.	**13**	1	L3

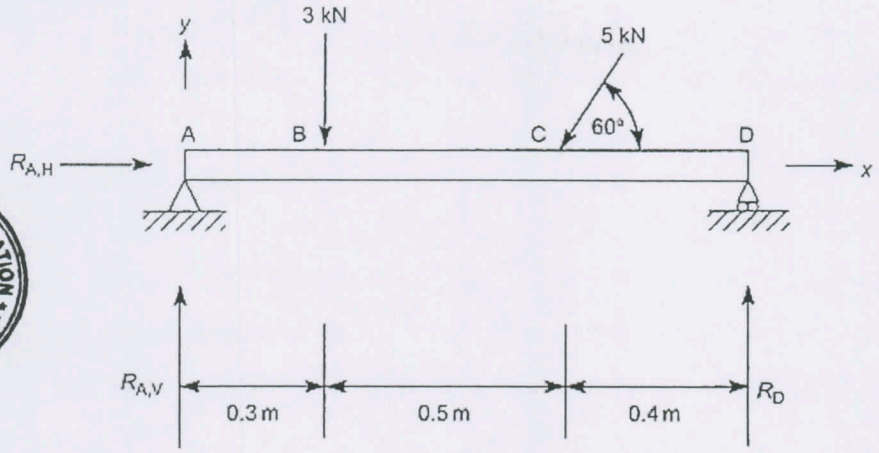


OR

11 (b)	Collars A and B are connected by a 25-in.-long wire and can slide freely on frictionless rods. If a 60-lb force Q is applied to collar B as shown, determine (a) the tension in the wire when x = 9 in., (b) the corresponding magnitude of the force P required to maintain the equilibrium of the system. (c) If P = 120 lb. and Q remains the same; determine the distances x and z for which the equilibrium of the system is maintained.	**13**	1	L3

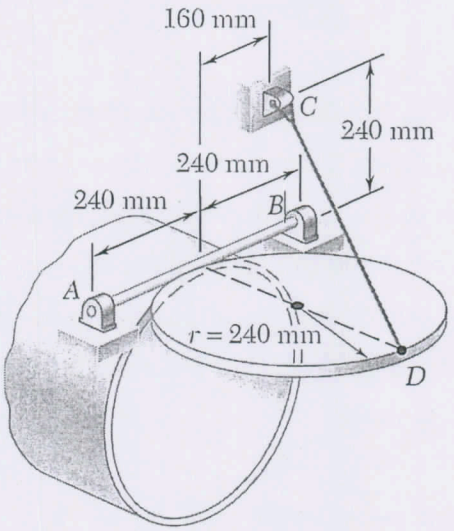


12 (a) For the beam shown in Figure below, find the reactions at the supports A and D. **13** 2 L3



OR

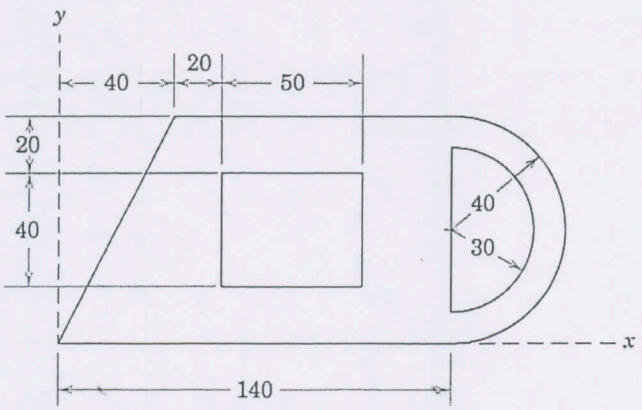
12 (b) A uniform pipe cover of radius r = 240 mm and mass 30 kg is held in a horizontal position by the cable CD. Assuming that the bearing at B does not exert any axial thrust, determine the tension in the cable and the reactions at A and B. **13** 2 L3



13 (a) Determine the Area Moment of Inertia of the C section whose flanges dimension is 100 mm × 20 mm and web dimension is 20 mm × 60 mm about its centroidal axis. **13** 3 L3

OR

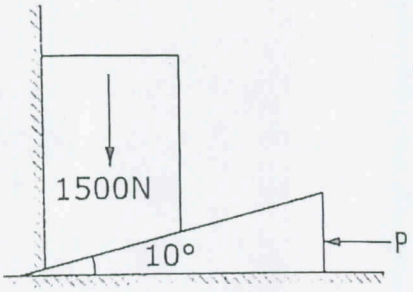
13 (b) Find the centroid of the sheet metal shown in figure below: (All dimensions are in mm). **13** 3 L3



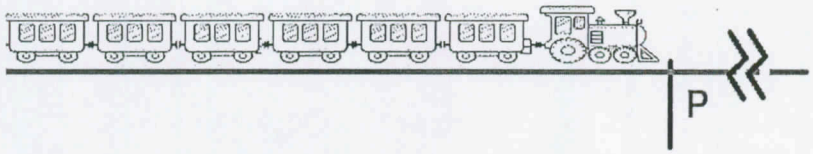
14 (a)	A ladder of length 12 m and weight 400 N is leaning against a vertical wall with an angle of 35^0 to the vertical. A man of weight 500 N climbs the ladder. If the wall is smooth, what is the position of the man that induces slipping of the ladder? Take $\mu = 0.3$ for ground.	**13**	4	L3

OR

14 (b)	Determine the minimum horizontal force P that should be applied to the wedge to raise the 1500 N block as shown in figure below.	**13**	4	L3



15 (a)	A train of length 950 m is running at a constant acceleration of 0.2 m/s^2 and travels 6 km in 3 minutes and attain its maximum allowable velocity. After that, the same velocity is maintained. i. Determine the initial and the final velocities. ii. At the instant, find the distance between the last compartment of the train and the fixed point of reference P in the first 30 seconds.	**13**	5	L3



OR

15 (b)	Two bodies one of mass 30 kg, moves with a velocity of 10 m/s strikes on an another body of mass 15 kg, moving in the opposite direction with the velocity of 10 m/s centrally. Find the velocity of each body after the impact, if the coefficient of restitution is 0.8.	**13**	5	L3

PART- C (1x 15=15Marks)

(Q.No.16 is compulsory)

Q. No		Questions	Marks	CO	BL
16.	i.	Identify the best among the methods of sections and method of joints to solve the truss problem shown in figure below.	**15**	2	L5
	ii.	Justify the method you choose to approach this problem.			
	iii.	Using the method you choose, determine the forces in the members AB, DB, and DE of the truss.