Q. Code: 542820

Reg. No. | | | | | | | | | | | | | |

B.E./ B.TECH. DEGREE EXAMINATIONS, MAY 2024

Second Semester

ME22201 – ENGINEERING MECHANICS

(Common to ME, MN, MR)

(Regulation 2022)

TIME:3 HOURS **MAX. MARKS: 100**

COURSE OUTCOMES	STATEMENT	RBT LEVEL
CO 1	Understand and analyze the various methods to determine the resultant forces and its equilibrium acting on a particle in 2D and 3D.	**2**
CO 2	Understand and analyze the concept of reaction forces and moment of various support systems with rigid bodies in 2D and 3D in equilibrium.	**2**
CO 3	Evaluate centroid, Area moment of Inertia and Mass moment of Inertia of cross section of any structural member.	**3**
CO 4	Correlate the engineering problems dealing with force, displacement, velocity and acceleration equations.	**3**
CO 5	Evaluate the problems in friction and rigid body dynamics.	**3**

PART- A(20x2=40Marks)

(Answer all Questions)

		CO	RBT LEVEL
1.	If θ = 30° and T = 6 kN , determine the magnitude of the resultant force acting on the eyebolt and its direction measured clockwise from the positive *x* axis.	**1**	**2**

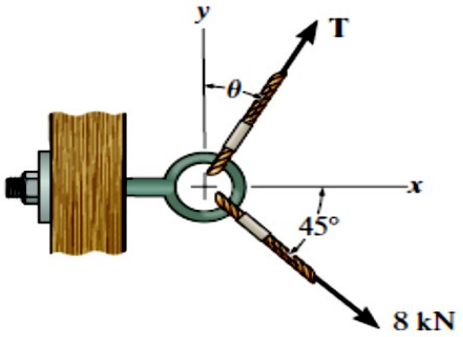


Figure.1

2.	A force of 80 N acts on a body at an angle of 30° with the horizontal. Resolve the force into rectangular components and determine their magnitudes.	**1**	**2**
3.	Draw the free body diagram for the given figure.2.	**1**	**2**

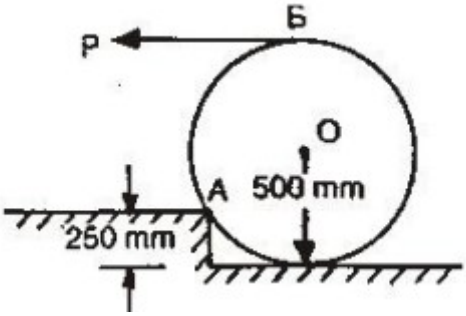


Figure.2

4.	Two forces of 400 N and 600 N act at an angle of 60° (Measured in counter clockwise direction from 400 N to each other. Determine the magnitude and direction of resultant force. Assume 400 N is acting towards positive x direction	**1**	**2**
5.	State varignon's theorem.	**2**	**2**
6.	Identify the support in the given diagram, shown in figure.3.	**2**	**2**

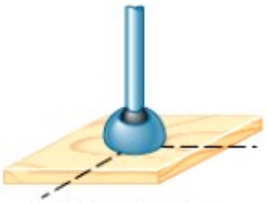


Figure.3

7.	Write the significance of 'moment of inertia'.	**2**	**2**
8.	Differentiate moment and couple.	**2**	**2**
9.	Define principal axes and principal moment of inertia.	**3**	**2**
10.	State parallel axis theorem.	**3**	**2**
11.	Define first moment of an area about of an axis.	**3**	**2**
12.	Define centroid of gravity.	**3**	**2**
13.	Define newtons law of motion.	**5**	**2**
14.	A point moves along a straight line according to the equation $x = 4t^3 + 2t + 5$, where x is in meters, t is in seconds. Determine the velocity and acceleration when t = 3 sec.	**5**	**3**
15.	Differentiate kinematics and kinetics.	**5**	**2**
16.	Two masses of 5 kg and 8 kg are connected by a light inextensible string which passes over a frictionless pulley. If the system is released from rest, find the acceleration of the masses and the tension in the string.	**5**	**3**
17.	Differentiate between static and dynamic friction.	**4**	**2**
18.	Write any two laws of friction.	**4**	**2**
19.	Why Coefficient of kinetic friction is less than that of static friction.	**4**	**2**
20.	What is general plane motion? Give some examples.	**4**	**2**

PART- B (5x 10=50Marks)

	Marks	**CO**	**RBT**

			LEVEL	
21. (a)	A particle of mass 2 kg is acted upon by three forces, 5 N, 12 N, and 13 N, all acting in the same plane. If the 12 N force acts at 45° to the 5 N force and the particle is in equilibrium, determine the angle between the 5 N and 13 N forces.	**(10)**	**1**	**3**

(OR)

(b)	Two cables are tied together at C and loaded as shown in figure.4. Knowing that P = 360 N, determine the tension (a) in cable AC, (b) in cable BC.	**(10)**	**1**	**3**

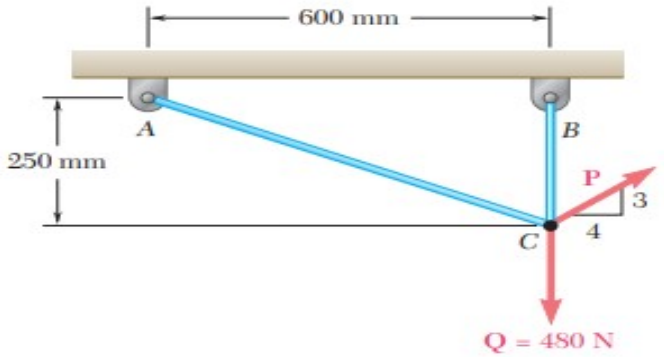


Figure.4

22. (a)	A 2.4-m boom is held by a ball-and-socket joint at C and by two cables AD and AE, shown in fig.5. Determine the tension in each cable and the reaction at C.	**(10)**	**2**	**3**

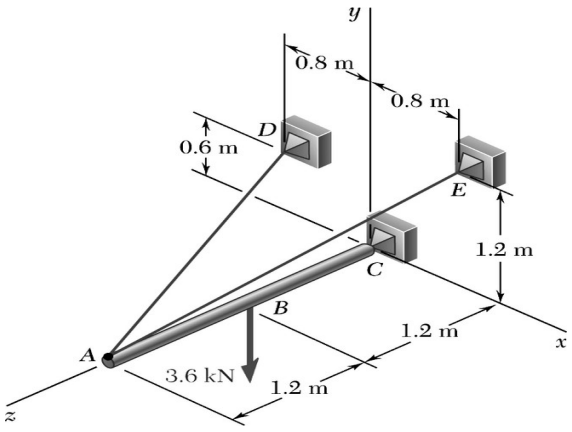
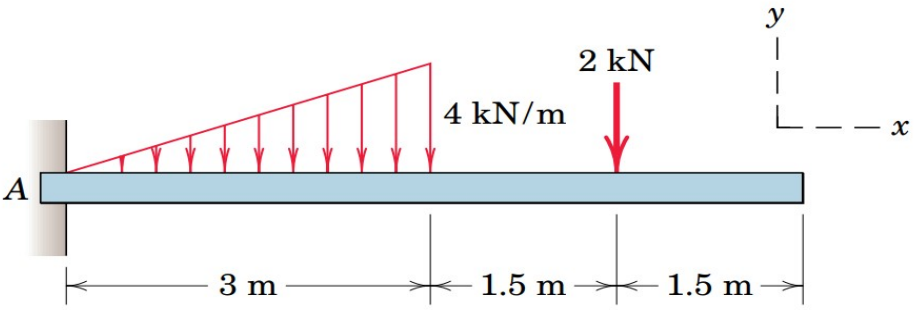


Figure.5

(OR)

(b) Determine the reactions at A for the cantilever beam subjected to the **(10) 2 3**



distributed and concentrated loads, shown in fig.6

Figure.6

23. (a) Determine the y-coordinate of the centroid of the shaded area, shown in **(10) 3 3** fig.7.

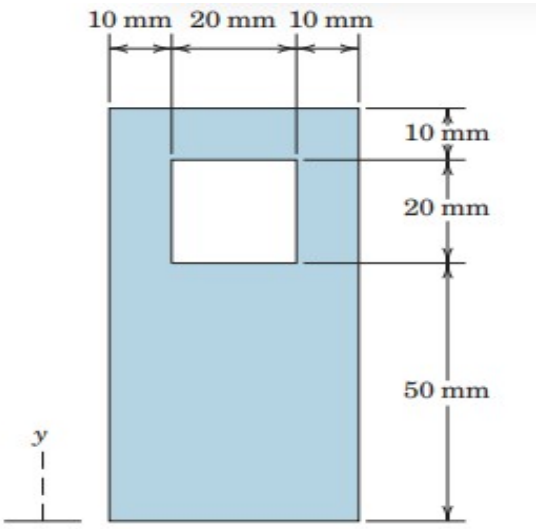


Figure.7

(OR)

(b)	Determine the centroid for a right-angle triangle with base, b and height, h, shown in figure.8.	**(10)**	**3**	**3**

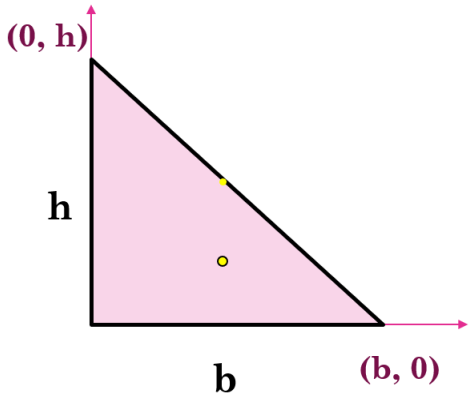


Figure.8

24. (a)	A 7m long ladder rests against a vertical wall, with which it makes an angle of 45° and on a level floor. If a man whose weight is one half that of the ladder climbs it, at what distance along the ladder will he be, when the ladder is about to slip? Take coefficient of friction between the ladder and the wall is 1/3 and that between the ladder and the floor is 1/2.	**(10)**	**5**	**3**
	(OR)			
(b)	A block weighing 500 N is on an inclined plane making an angle of 30° with the horizontal. If the coefficient of friction between the block and the plane is 0.3, calculate the force required to move the block up the plane.	**(10)**	**5**	**3**
25. (a)	A racing car enters the final straight travelling at 35 m s^{-1}, and covers the 600 m to the finishing line in 12 s. Assuming constant acceleration, find the car's speed as it crosses the finishing line.	**(10)**	**4**	**3**
	(OR)			
(b)	A block weighing 50 N is pushed with a force of 20 N along a horizontal plane. If the coefficient of friction between the block and the plane is 0.3, determine the acceleration of the block.	**(10)**	**4**	**3**

PART- C (1x 10=10Marks)

(Q.No.26 is compulsory)

		Marks	CO	RBT LEVEL
26.	What is the least value of 'P' required to cause the motion impend, the system shown in Figure.9 Assume coefficient of friction on all contact	**(10)**	**5**	**5**

surfaces as 0.2.

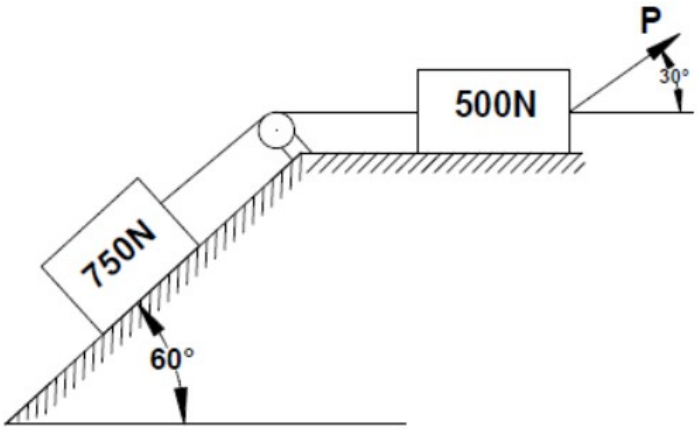


Figure.9

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