CBCS SCHEME

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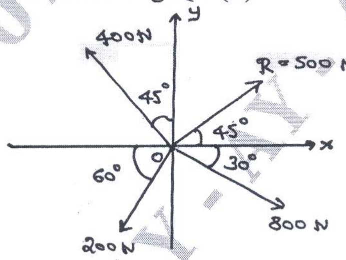
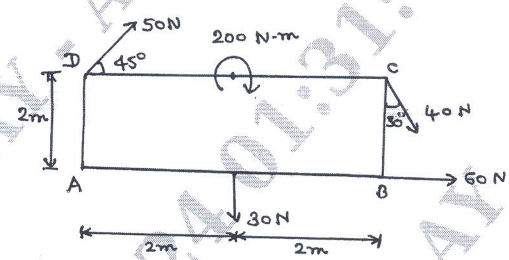
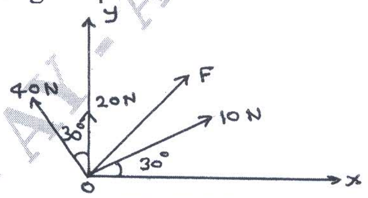
BCIVC103/203

ACHARYA INSTITUTE OF TECHNOLOGY MCA Library Date ... BANGALORE

First/Second Semester B.E./B.Tech. Degree Examination, June/July2024
Engineering Mechanics

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Explain the following: i) Principle of transmissibility of a force ii) Composition of forces and resolution of a force.	6	L2	CO1
	b.	Determine the fourth unknown force in magnitude and direction so that the resultant $\vec{R}$ acts as shown in the Fig.Q.1(b).  Fig.Q.1(b)	6	L3	CO1
	c.	Compute the resultant of the force system shown in the Fig.Q.1(c) with respect to point A. Also, locate the point where the resultant cuts the line AB.  Fig.Q.1(c)	8	L3	CO1, 2
		OR			
Q.2	a.	State and prove principle of moments.	6	L2	CO1
	b.	Determine the unknown force $\vec{F}$ and its direction so that the resultant $\vec{R}$ of magnitude 72N acts along the positive direction of Y axis (↑).  Fig.Q.2(b)	6	L3	CO1

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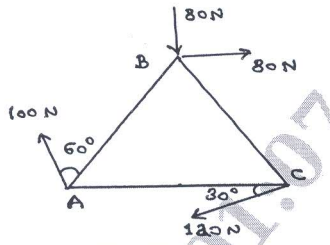
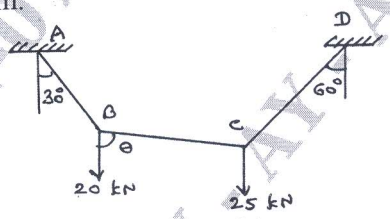
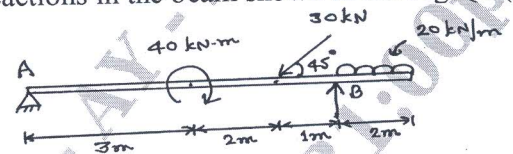
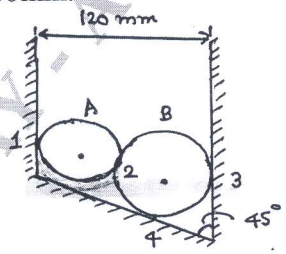
	c.	Compute the magnitude and direction of the resultant of the force system shown in the Fig.Q.2(c) with respect to point A of the equilateral triangle ABC. Side of triangle is 100mm. Also, find the location of the resultant along the edge AC.  Fig.Q.2(c)	8	L3	CO1

Module – 2

Q.3	a.	Define equilibrium. State the conditions for the equilibrium of coplanar i) Concurrent force system ii) non-concurrent force system.	5	L2	CO2
	b.	In the given string system, determine the tensions in the strings and the angle θ for equilibrium.  Fig.Q.3(b)	7	L3	CO2
	c.	Determine the reactions in the beam shown in the Fig.Q.3(c).  Fig.Q.3(c)	8	L3	CO2

OR

Q.4	a.	Distinguish between : i) Statically determinate and indeterminate beams. ii) Hinged support and fixed support.	6	L2	CO2
	b.	Compute the reactions at the contact points in the system shown (1, 2, 3, 4). Weight of sphere A = 50N Weight of sphere B = 80N Diameter of sphere A = 50mm Diameter of sphere B = 100mm.  Fig.Q.4(b)	8	L3	CO2

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c. Determine the support reactions in the beam shown : — 6 | L3 | CO2

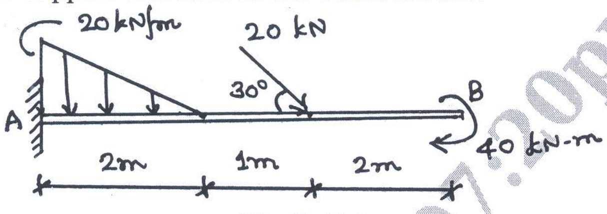

Fig.Q.4(c)

Module – 3

Q.5 a. Determine the forces in the members of the truss shown in the figure by the method of joints. — 10 | L3 | CO3

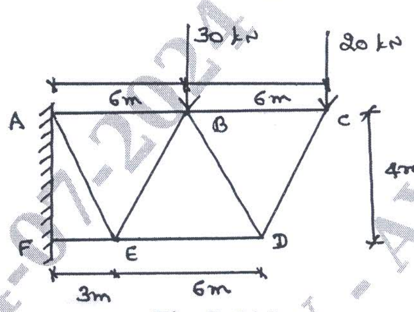

Fig.Q.5(a)

b. State the laws of dry friction. — 3 | L2 | CO3

c. A weight 500N just starts moving down a rough inclined plane supported by a force of 200N acting parallel to the plane and it is at the point of moving up the plane when pulled by a force of 300N parallel to the plane. Find the inclination of the plane and the coefficient of friction between the inclined plane and the weight. — 7 | L3 | CO3

OR

Q.6 a. Compute the forces in the members of the truss shown in the Fig.Q.6(a) by the method of joints. — 10 | L3 | CO3

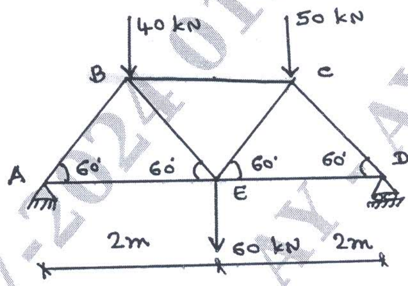

Fig.Q.6(a)

b. Distinguish between angle of friction and angle of repose. Illustrate with a sketch. — 3 | L2 | CO3

c. A uniform ladder 4m long weighing 300N is placed against a vertical wall with an angle 60° with the floor. The coefficient of friction between the wall and the ladder is 0.25 and that between floor and ladder is 0.35. The ladder has to support a load of 1500N at its top. Find the horizontal force P to be applied at the bottom of the ladder to just prevent slipping. — 7 | L3 | CO3

Module – 4

Q.7	a.	From first principles, derive the expression for locating the centroid of a semi-circular section.	6	L3	CO4
	b.	Illustrate: i) Parallel axis theorem ii) Perpendicular axis theorem.	4	L2	CO4
	c.	Determine the polar moment of inertia of the I-section shown in Fig.Q.7(c). All the dimensions are in mms.	10	L3	CO4

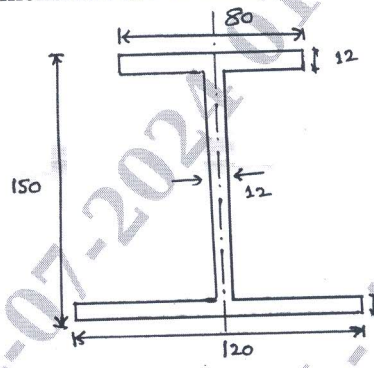

Fig.Q.7(c)

OR

Q.8	a.	Derive the expression for the moment of inertia of a triangular section about its base. Hence, arrive at the expression about its parallel centroidal axis.	6	L3	CO4
	b.	Define and give the mathematical expressions for : i) Moment of inertia ii) Radius of gyration.	4	L2	CO4
	c.	Locate the centroid of the shaded lamina shown in the Fig.Q.8(c). Given that the centroid of the circle and the shaded lamina coinside.	10	L3	CO4

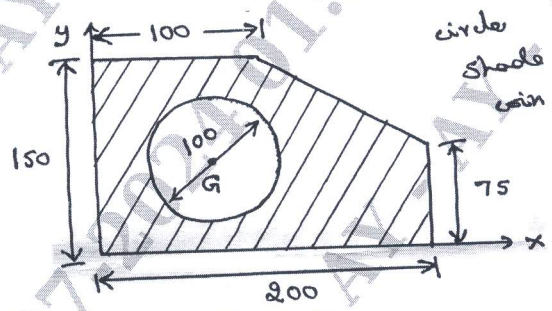

Fig.Q.8(c)

Module – 5

Q.9	a.	Derive the three fundamental equations of linear motion.	6	L2	CO1
	b.	Determine the least initial velocity with which a projectile is to be projected so that it clears a wall 4m height located at a distance of 5m, and strikes the horizontal plane through the foot of the wall at a distance 4m beyond the wall. The point of projection is at the same level as the foot of the wall.	6	L3	CO5

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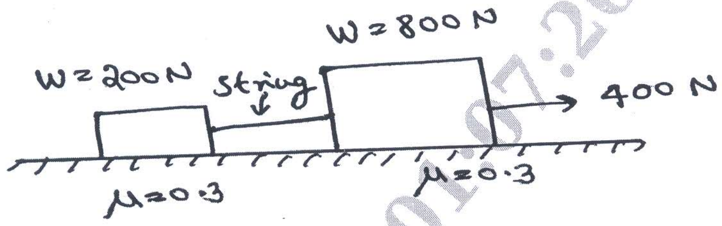
	c.	Compute the acceleration of the system and the tension in the string shown in the Fig.Q.9(c). Adopt D'Alembert's principle.  Fig.Q.9(c)	8	L3	CO5
		OR			
Q.10	a.	State and explain D'Alembert's principle. Give an example.	6	L2	CO5
	b.	A ball is thrown vertically upwards with an initial velocity of 36m/s. After 2 seconds, another ball is thrown vertically upwards. What should be its initial velocity so that it crosses first ball at a height of 30m?	8	L3	CO5
	c.	A projectile is aimed at a target on the horizontal plane and falls 12m short when the angle of projection is 15°, while it overshots by 24m when the angle is 45°. Determine the angle of projection to hit the target.	6	L3	CO5

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