Name: **Enrolment No:**	UPES UNIVERSITY OF TOMORROW

UPES

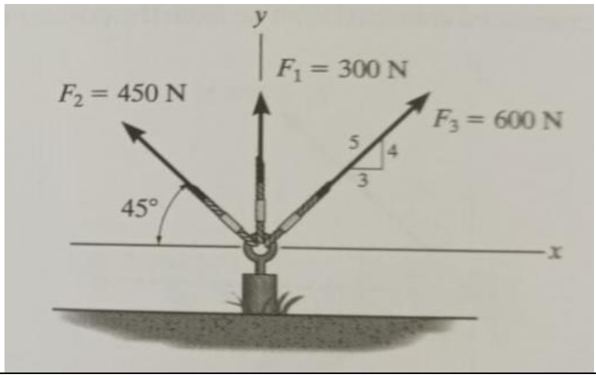
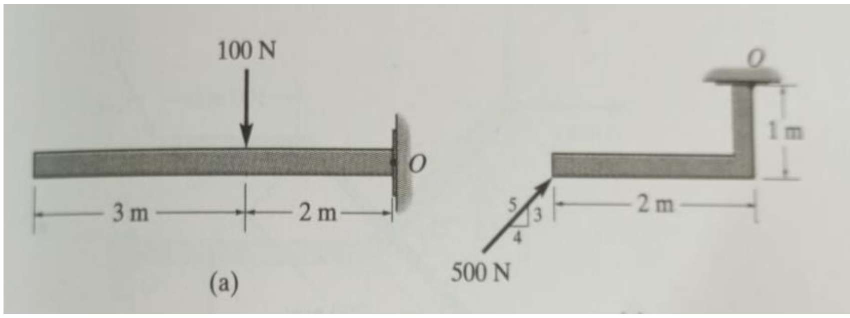
End Semester Examination, December 2023

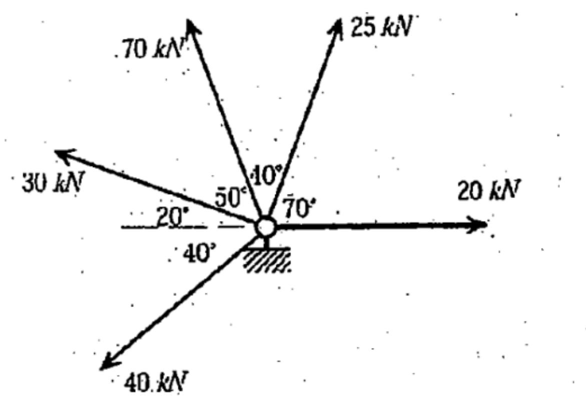
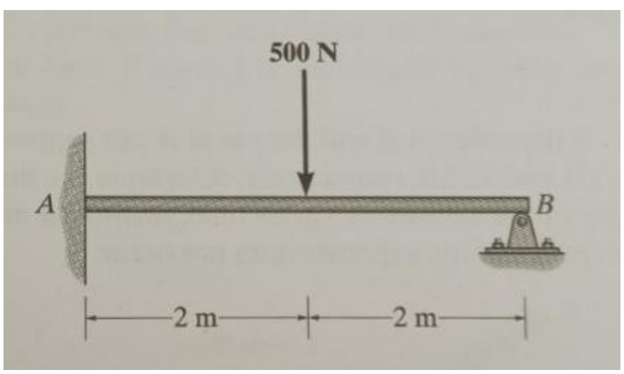
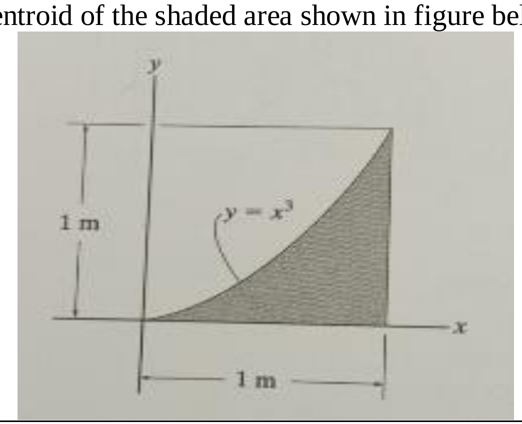
Course: Engineering Mechanics | **Semester : III**
Program: B.Tech Civil Eng & Sustainability Eng | **Time : 03 hrs.**
Course Code: MECH2031 | **Max. Marks: 100**

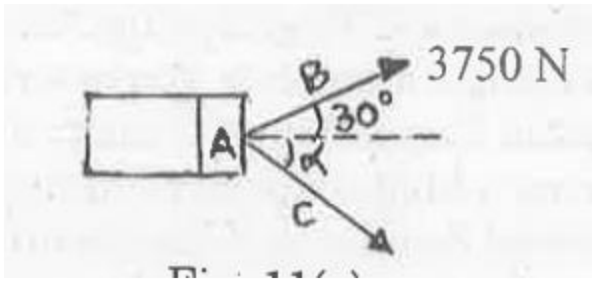
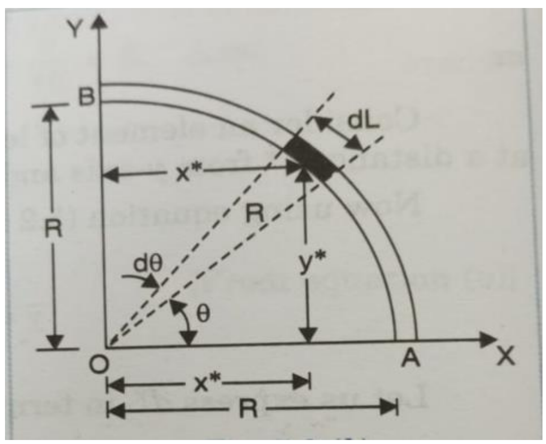
Instructions: Attempt all questions.

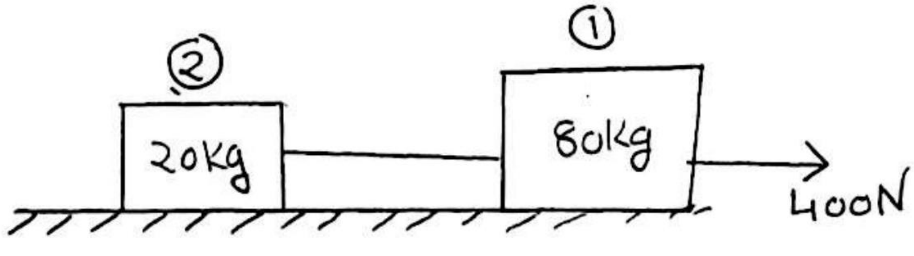
SECTION A

(5Qx4M=20Marks)

S. No.		**Marks**	**CO**
Q 1	Resolve each force acting on the post into its x and y components.  	**4**	**CO2**
Q 2	Define coefficient of friction and angle of friction. Establish a relation between them.	**4**	**CO1**
Q 3	What are the conditions of equilibrium in concurrent and non-concurrent force system?	**4**	**CO1**
Q 4	State the principle of virtual work and law of conservation of momentum.	**4**	**CO2**
Q 5	In each case shown below, determine the moment of a force about point O.  	**4**	**CO2**

SECTION B (4Qx10M= 40 Marks)			
Q 6	State the theorems of Pappus and Guldinus. Illustrate it with the determination of (a) Surface area of a cylinder (Radius R and Length L), (b) Volume of Sphere of radius R.	**10**	**CO3**
Q 7	Determine the magnitude and direction of the resultant of the forces acting on the ring as shown in figure below.  	**10**	**CO3**
Q 8	Determine the reactions at the supports A and B on the rod.  	**10**	**CO3**
Q 9	Determine the centroid of the shaded area shown in figure below.  	**10**	**CO2**

SECTION-C (2Qx20M=40 Marks)			
Q 10	(a) A disabled automobile is pulled by means of two ropes as shown. Knowing that the tension in rope AB is 3750 N, determine by trigonometry the tension in rope AC and the value of angle, so that the resultant force exerted at A is a 6000 N force directed along the axis of the automobile. 	10	CO3
	(b) Determine the center of gravity of a quadrant AB of the arc of the circle of Radius R as shown in figure below. 	10	
Q 11	State and prove Parallel axis and Perpendicular axis theorm of moment of inertia. Also, explain Radius of gyration. **OR** State and explain the following terms: (a) Co-efficient of Friction and Angle of Friction, (b) Work Energy Theorm, (c) D' Alembert Principle. Two bodies of masses 80 kg and 20 kg are connected by a thread along a rough horizontal surface under the action of force 400 N applied to the first body of mass 80 kg as shown in figure below. The coefficient of friction between the sliding surfaces of the bodies and plane is 0.3. Determine the acceleration of the two bodies and the tension in the thread using D' Alembert Principle.	20	CO2

	 2 20kg 1 80kg 400N		