Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1(S) Examinations May 2026 (2024 Scheme)

Course Code: GCEST103

Course Name: ENGINEERING MECHANICS

Max. Marks: 60 Duration: 2 hours 30 minutes

PART A

(Answer all questions. Each question carries 3 marks)

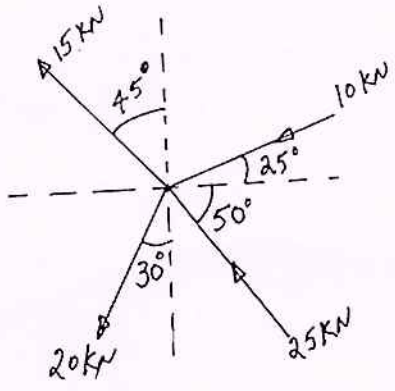
		CO	Marks
1	Explain the conditions of equilibrium for coplanar concurrent and coplanar non-concurrent force systems.	(CO3)	(3)
2	A force of magnitude 200 N acts along the direction from A to B. The coordinates of A and B are (3,2, -4) and (9,8,7). Find the force vector.	(CO1)	(3)
3	Explain the angle of friction and the angle of repose. What is the relation between the two?	(CO4)	(3)
4	Explain the terms radius of gyration and polar moment of Inertia.	(CO4)	(3)
5	Explain D'Alembert's principle.	(CO4)	(3)
6	A stone is thrown vertically upward with a velocity of 50 m/s. Find the maximum height reached by the stone and the time to reach maximum height.	(CO5)	(3)
7	A ball is thrown with a velocity of 5 m/s at an angle of 60° with the horizontal. Find the velocity of another ball thrown at an angle of 45° with the horizontal, when both the balls cover the same horizontal range.	(CO5)	(3)
8	A pulley starts from rest and is given an acceleration of 0.6 rad/s^2. What will be its speed in rpm at the end of 1 minute?	(CO5)	(3)

PART B

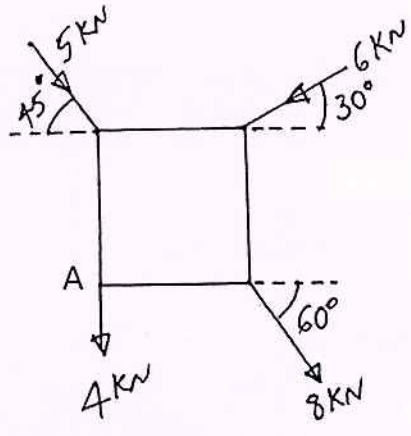
(Answer any one full question from each module, each question carries 9 marks)

Module -1

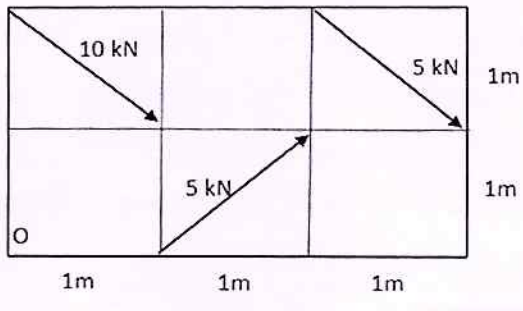
9	a)	The forces acting at a point are shown in the figure. Find the magnitude and direction of the resultant force.	(CO2)	(4)



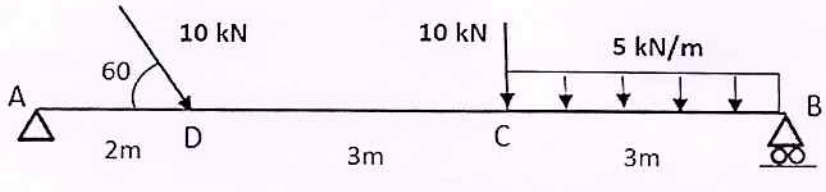
b) Find the magnitude and direction of the resultant force of the given force system. Also, locate the line of action of the resultant with respect to point A if the sides of the square are 1m each. (CO2) (5)



10 a) For the given force system, find the magnitude and the direction of the resultant force. (CO2) (4)

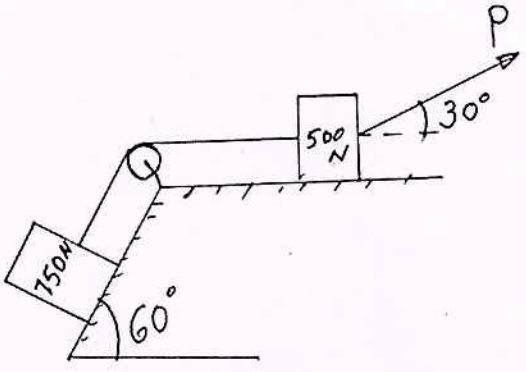


b) Determine the reactions at the supports of the beam shown in the figure. (CO3) (5)

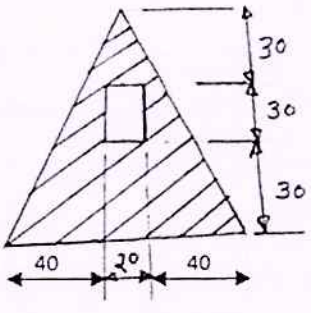


Module -2

11 a) Two blocks of weights 750 N and 500 N are connected as shown in the figure. Find the value of force 'P' to just start the motion along the direction of 'P'. Assume the pulley is smooth and the coefficient of friction for all the contact surfaces is 0.2. (CO3) (9)



12 a) Find the moment of inertia of the given shaded area about the horizontal centroidal axis. All dimensions in mm. (CO4) (9)

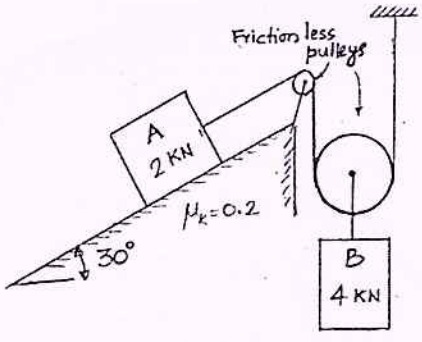


Module -3

13 a) The motion of a particle moving in a straight line is given by the expression $s=18t+3t^2-2t^3$, where s is the displacement in metres, and t is the time in seconds. Determine the velocity and acceleration at the start, the maximum velocity, and the time to reach maximum velocity. (CO5) (4)

b) Two cars are travelling towards each other on a straight road at velocities of 12 m/s and 9 m/s, respectively. When 100 meters apart, both drivers applied the brakes simultaneously to avoid a collision, and the cars came face to face without any gap. Assume constant retardation for each case. Determine a) the time required by cars to stop, b) the distance travelled by each car (CO5) (5)

14 a) If the system shown in the figure starts from rest, compute the velocity of blocks A and B when block B has moved a distance of 3m. Take the coefficient of friction as 0.2. Assume the pulley is smooth. Also, find tension in the rope. (CO5) (9)



Module -4

15 a) A projectile falls 12m short of the target when the angle of projection is 15° and overshoots by 20m when the angle of projection is 45°. Find the angle of projection to hit the target. (CO5) (4)

b) The horizontal component of the velocity of a projectile is twice its initial vertical component. Find the range if the projectile passes through a point 18 m horizontally and 3m vertically above the point of projection. (CO5) (5)

16 a) A solid cylindrical pulley of mass 800 kg has a radius of gyration of 80 cm. The diameter of the pulley is 2 m. It is rotated by an electric motor, which exerts a uniform torque of 60 kNm. A body of mass 3000 kg is to be lifted by a wire wrapped around the pulley. Find the acceleration of the body and the tension in the rope. (CO5) (9)

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