Sub code:R25ES11		R25

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY
(UGC - Autonomous)
(Approved by AICTE, Recg. by Govt. of T.G & Affiliated to JNTU, Hyderabad) NAAC "A" Accredited Institute

B.Tech I Year I Semester Regular Examinations, December-2025 / January -2026

ENGINEERING MECHANICS
((Common to MECH)

Time: 3hours | **Max. Marks: 60**

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 10 marks. Answer all questions in Part A.
Part B consists of ten questions from 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b as sub questions.

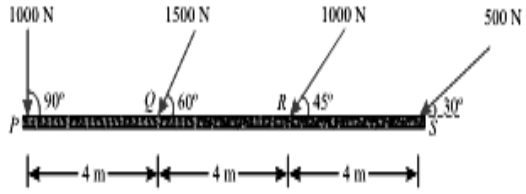
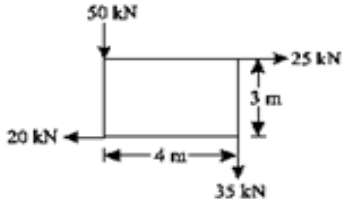
PART-A

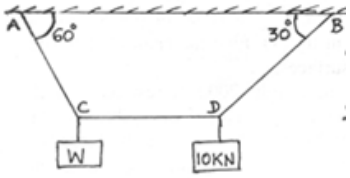
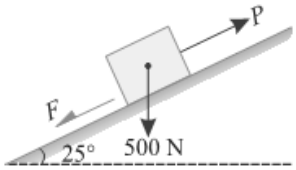
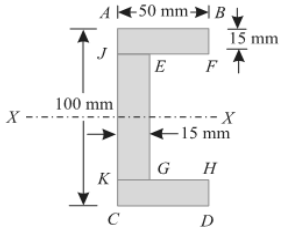
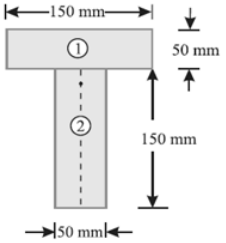
(10 Marks)

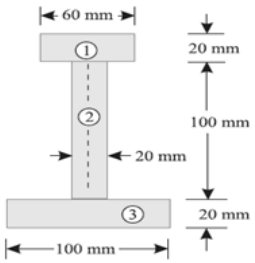
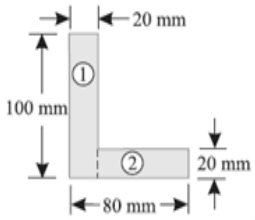
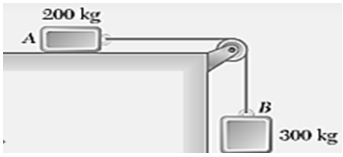
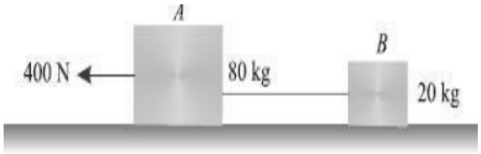
			BT Level	Marks
1.	a	Outline the conditions for equilibrium of a rigid body which is under coplanar non-concurrent system.	L2	2M
	b	Distinguish between coefficients of static friction and coefficient of dynamic friction.	L2	2M
	c	State the parallel axis theorem, write its formula.	L2	2M
	d	State the principle of linear and angular impulse-momentum.	L2	2M
	e	Determine the final velocity of a 2 kg particle moving with an initial velocity of 3 m/s. A force of 5 N in the direction of motion is applied over a distance of 4 m.	L2	2M

PART-B

(50 Marks)

2.	a)	State and prove Lami's theorem.	L2	4M
	b)	Determine the magnitude, direction and position of the resultant of system for a horizontal rod of PQRS is 12 M long, where PQ = QR = RS = 4 m. Forces of 1000, 1500, 1000 and 500 N act at P, Q, R and S respectively and action of these forces make angles 90^0, 60^0, 45^0 and 30^0 respectively. 	L3	6M
		OR		
3.	a)	Determine the magnitude and direction of the resultant force for a system of forces acting at the corners of a rectangular block as shown in Figure. 	L3	5M

	b)	Solve for the value of W for a cord supported at A and B with CD remaining horizontal, the cord carrying a load of 10 kN at D and a load of W at C as shown in figure.  	L3	5M
4.	a)	Determine the minimum and maximum values of P for a body of weight 500 N lying on a rough plane inclined at an angle of 25° with the horizontal. It is supported by an effort (P) parallel to the plane as shown in figure, for which equilibrium can exist when angle of friction is 20^0.  	L3	5M
	b)	Determine the weight of the body and the coefficient of friction, for a body, resting on a rough horizontal plane; requiring a pull of 180 N inclined at 30° to the plane just to move it. It was found that a push of 220 N inclined at 30° to the plane just moved the body.	L3	5M
		OR		
5.	a)	Calculate the force required at the end of a lever 400 mm long measured from the axis of the screw of a screw jack that can raise a load of 40 KN. The screw is square threaded having three threads per 20 mm length and 40 mm in diameter. The coefficient of friction between screw and nut is 0.12.	L3	5M
	b)	Find the centre of gravity of a channel section 100 mm × 50 mm × 15 mm, shown in the figure.  	L3	5M
6.	a)	State and prove the parallel axis theorem in the determination of moment of inertia of areas with the help of a neat sketch.	L2	4M
	b)	Calculate the moment of inertia of a T-section with flange as 150 mm × 50 mm and web as 150 mm × 50 mm about X-X and Y-Y axes through the center of gravity of the section as shown in figure.  	L3	6M
		OR		

7.	a)	Calculate the Moment of inertia of an I-section about the horizontal axis passing through the center of gravity of the section. I-section is made up of three rectangles as shown in figure.  	L3	5M
	b)	Determine the moment of inertia about the centroidal X-X and Y-Y axes of the angle section shown in Figure.  	L3	5M
8.	a)	Determine i) the velocity of car A moving relative to car B and ii) the velocity of car B moving relative to car A. The car A travels at a speed of 30 m/ sec and car B travels at a speed of 20 m/ sec in the opposite direction.	L3	5M
	b)	Calculate i) acceleration ii) distance travelled and iii) time required for reaching a velocity of 36 km/hr of a train. The train starts from rest and attains a velocity of 45 km/hr in 2 minutes, with uniform acceleration.	L3	5M
		OR		
9.	a)	Determine (i) impulse of force and (ii) average force exerted by the floor on a ball of mass 0.05 kg with period of impact as 0.12 seconds. The ball is dropped from a height of 12 m on a floor, and rebounds to a height of 8 m.	L3	5M
	b)	Calculate the velocity of bullet and loss in energy of the system of a bullet weighing 0.3 N fired horizontally into a body weighing 100 N which is suspended by a string 0.8 m long. Due to this impact the body swings through an angle of 30^0.	L3	5M
10.		Solve the problem by using work energy method, for two blocks joined by an inextensible cable as shown in figure. If the system is released from rest, find the velocity of block A after it has moved 2 m. Assume that the coefficient of kinetic friction between block A and the plane is 0.25 and that the pulley is weightless and frictionless.  	L3	10M
		OR		
11.		Solve the problem by using D' Alembert's principle, for two bodies A and B of mass 80 kg and 20 kg connected by a thread and move along a rough horizontal plane under the action of a force 400 N, applied to the first body of mass 80 kg as shown in Figure. The coefficient of friction between the sliding surfaces of the bodies and the plane is 0.3. Find the acceleration of the two bodies and the tension in the thread.  	L3	10M
