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Question Paper Code : 30072

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

First/Second Semester

Mechanical Engineering

ME25C02 – ENGINEERING MECHANICS

(Common to : Aeronautical Engineering/ Aerospace Engineering/Automobile Engineering/Biomedical Engineering/Civil Engineering/Civil Engineering (Environmental Engineering) /Environmental Engineering/Environmental Science and Technology/Industrial Engineering and Management/Manufacturing Engineering/Marine Engineering/ Mechanical Engineering (Specialised in Automobile)/Mechanical Engineering (Specialized in Smart Manufacturing)/ Mechanical and Automation Engineering/Mechatronics Engineering/Medical Electronics /Robotics and Automation/ Agricultural Engineering/Handloom and Textile Technology/Textile Chemistry /Textile Technology)
(Regulations 2025)

Time : 3 hours

Maximum : 100 marks

CO – Course Outcomes

CO1	Explain the principles of statics in determination of forces acting on particles and rigid bodies
CO2	Apply equilibrium conditions to predict the behavior of particles and rigid bodies under various force configurations
CO3	Analyse various systems through resolution of forces and moments
CO4	Demonstrate the ability to engage in adapting new techniques in the analysis of force and moments in a system

BL – Bloom's Taxonomy Levels

(L1-Remember, L2-Understand, L3-Apply, L4-Analyze, L5-Evaluate, L6-Create)

Answer ALL questions.

PART – A (Total Marks = 40)

[Q. No. 1 to Q. No. 10 ; $10 \times 1 = 10$ Marks (Multiple Choice Questions)]

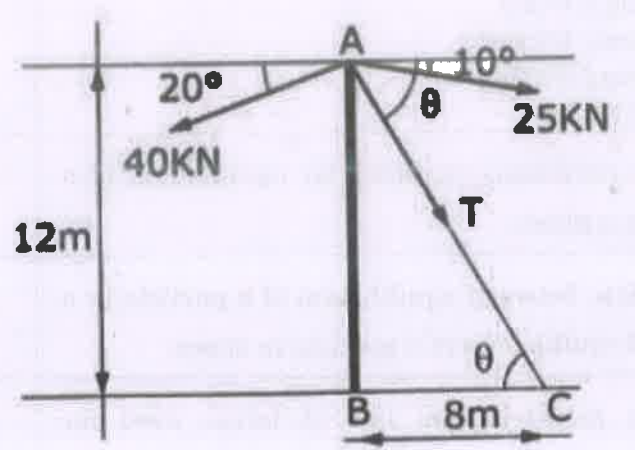
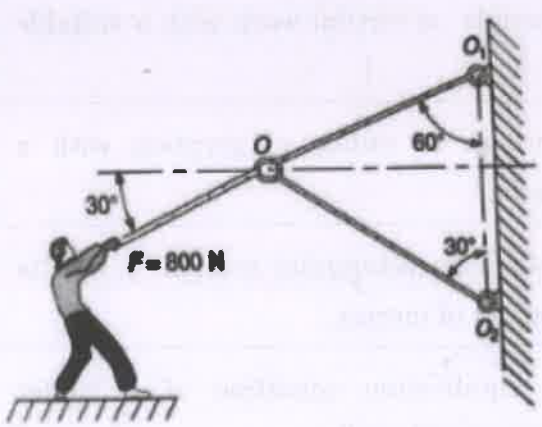
Q. No. 11 to Q. No. 20; $10 \times 3 = 30$ Marks]

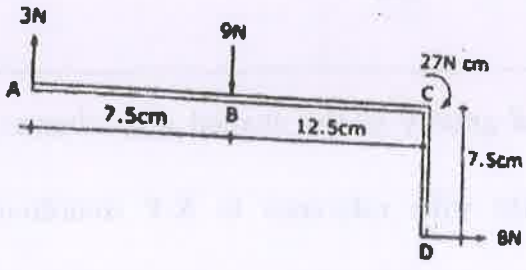
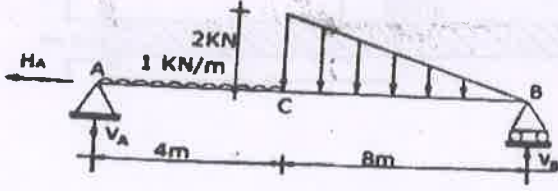
Q.No.	Questions	Marks	CO	BL
1.	The resultant of two concurrent forces acting at a point is obtained using (A) Lami's theorem (B) Polygon law of forces (C) Varignon's theorem (D) Hooke's law	1	1	1

2.	In space force systems, concurrent forces meet at (A) Two points (B) One common point (C) Parallel lines (D) Random points	1	1	2
3.	The resultant of concurrent forces in space can be determined using (A) Scalar addition (B) Vector addition (C) Integration (D) Differentiation	1	1	1
4.	A Free Body Diagram (FBD) is used to (A) Calculate velocity (B) Show all external forces acting on a body (C) Determine temperature distribution (D) Measure displacement	1	2	1
5.	The SI unit of moment is (A) N (B) N/m (C) Nm (D) m/N	1	2	2
6.	In three-dimensional equilibrium of a rigid body, the total number of equilibrium equations is (A) 2 (B) 3 (C) 4 (D) 6	1	2	2
7.	The parallel axis theorem is used to determine (A) Radius of gyration (B) Product of inertia (C) Moment of inertia about any parallel axis (D) Centroid of an area	1	3	1
8.	The product of inertia of an area becomes zero when the reference axes are (A) Inclined axes (B) Parallel axes (C) Principal axes (D) Polar axes	1	3	2

9.	The angle of friction is defined as the angle between (A) Applied force and weight (B) Normal reaction and resultant reaction (C) Friction force and applied force (D) Weight and normal reaction	1	4	1
10.	Which type of friction acts when a body is just about to move? (A) Rolling friction (B) Dynamic friction (C) Limiting friction (D) Fluid friction	1	4	1
11.	State the conditions required for equilibrium of a particle in a plane.	3	1	1
12.	Differentiate between equilibrium of a particle in a plane and equilibrium of a particle in space.	3	1	2
13.	State the parallelogram law of forces used for finding the resultant of two concurrent forces.	3	1	1
14.	Mention the principle of transmissibility of forces with its applications.	3	2	1
15.	List the characteristics of a couple and force-couple system.	3	2	2
16.	State the principle of virtual work with a suitable example.	3	2	1
17.	State the concept of radius of gyration with a suitable formula.	3	3	2
18.	Distinguish between rectangular moment of inertia and polar moment of inertia.	3	3	2
19.	Identify the equilibrium condition of a ladder resting against a rough wall.	3	4	2
20.	Write short notes on belt friction and its engineering applications.	3	4	1

PART – B ($5 \times 12 = 60$ marks)

Q.No.	Questions	Marks	CO	BL
21. (a)	Two cables which have known tensions are attached to the top of a tower AB. A third cable AC is used as a guide wire as shown in the Figure 21(a). Determine the tension in AC if the resultant of the forces exerted at A by the three cables acts vertically downwards.  Figure 21 (a)	12	1	3
OR				
(b)	Two cables are tied together at the point O and loaded as shown in the Figure 21(b). Determine the tensions in OO_1 and OO_2.  Figure 21 (b)	12	1	3

22. (a)	For the drawing shown in Figure 22(a). Calculate the following, (i) The resultant of the system, (ii) The points of the intersection of its line of action with AC and CD. (iii) The 27 N-cm couple applied at C is removed and replaced by a couple of unknown magnitude M. Determine the value of M if the resultant force is to pass through C.  Figure 22 (a)	12	1	4
OR				
(b)	Calculate the support reactions of a simply supported beam as shown in the Figure 22(b).  Figure 22 (b)	12	1	4

23.	(a)	A wall-mounted jib crane is supported by a pin at point A and a roller support at point B located 2 m below A. The crane has a mass of 1200 kg acting at its center of gravity G, located 2.5 m horizontally from the wall. It carries a load of 3000 kg at the free end, 5 m from the wall. Determine the horizontal and vertical reactions at supports A and B.	12	2	4
OR					
(b)	Find the center of gravity of the shaded area shown in below Figure 23(b) with reference to X-Y co-ordinate system.		12	2	4
Figure 23 (b)					

24. (a) Find the moment of inertia of a T-section with flange as $150 \text{ mm} \times 50 \text{ mm}$ web as $50 \text{ mm} \times 150 \text{ mm}$ about X-X and Y-Y axes through the center of gravity of the section as shown in Figure 24(a).

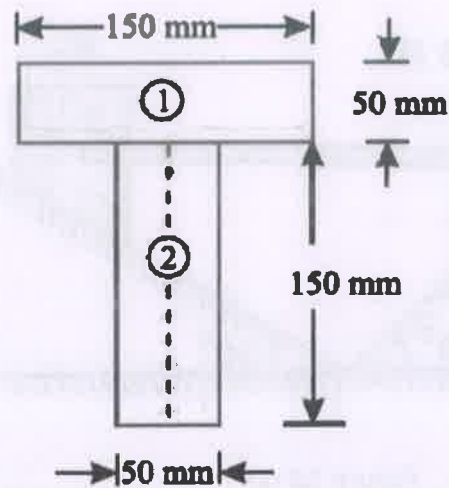


Figure 24 (a)

OR

- (b) A rectangular hole is made in a triangular section as shown in Figure 24(b). Determine the moment of inertia of the section about X-X axis passing through its center of gravity and the base BC.

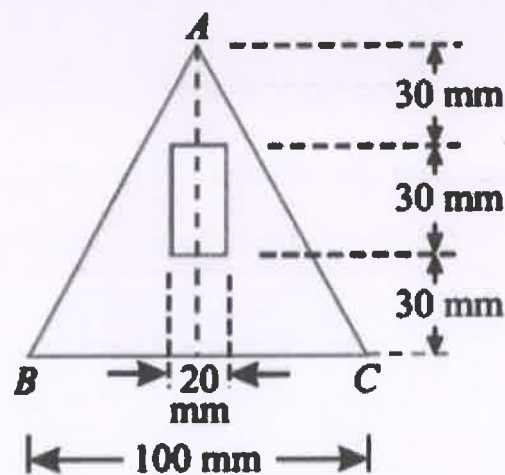
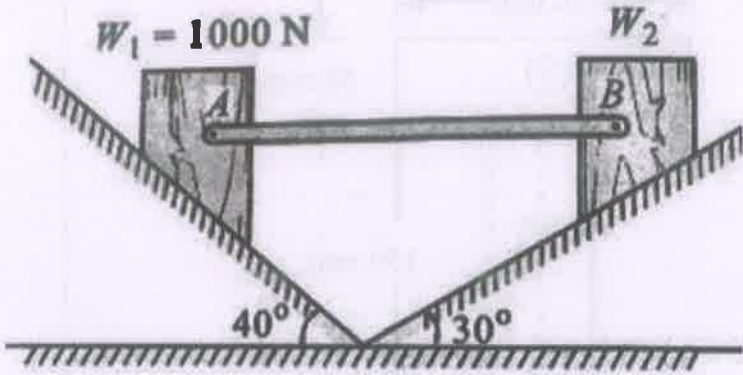


Figure 24 (b)

12 3 3

12 3 3

25.	(a)	Two blocks W_1 and W_2 resting on two inclined planes are connected by a horizontal bar AB as shown in Figure 25(a). If W_1 is equals 1000 N, determine the maximum value of W_2 for which the equilibrium can exists. The angle of limiting friction is 20° at all rubbing faces.	12	4	4
 Figure 25 (a)					
OR					
(b)		A ladder 5 meters long rests on a horizontal ground and leans against a smooth vertical wall at an angle 70° with the horizontal. The weight of the ladder is 900 N and acts at its middle. The ladder is at the point of sliding, when a man weighing 750 N stands on a rung 1.5 meter from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.	12	4	4