Name: Enrolment No:	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

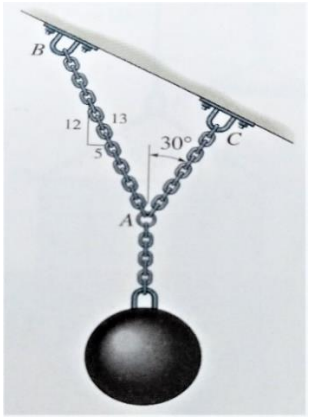
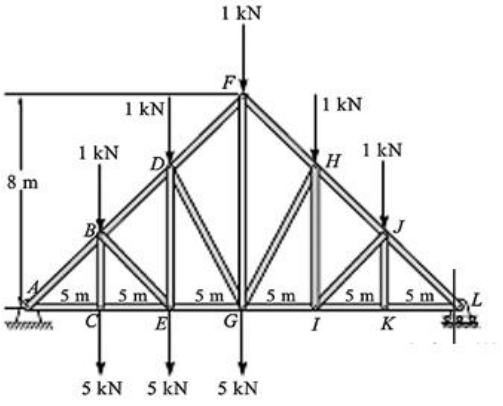
END Semester Examination, December 2021

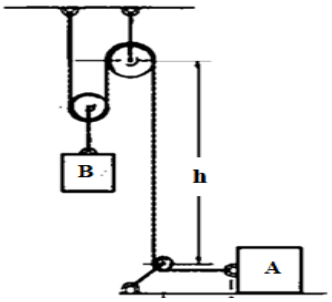
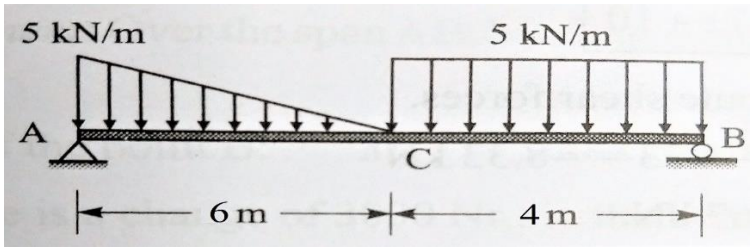
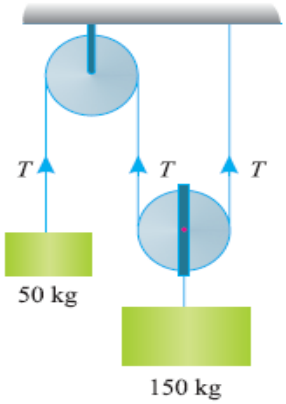
Programme Name: B.Tech- ME, Mechanical, ADE **Semester : III**
Course Name : Engineering Mechanics **Time : 03 hrs.**
Course Code : MECH 2031 **Max. Marks: 100**
Nos. of page(s) : 4

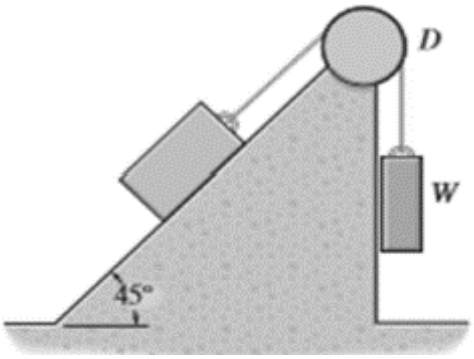
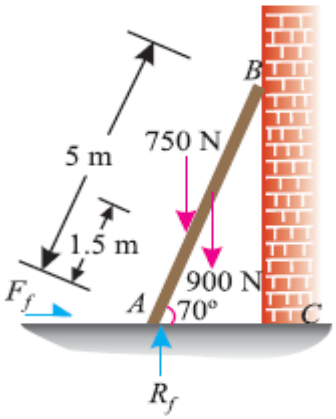
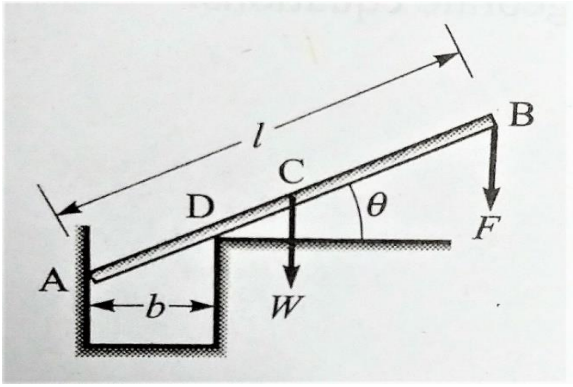
Instructions:

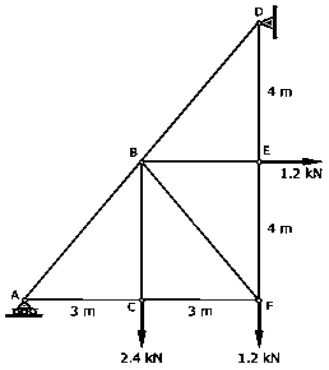
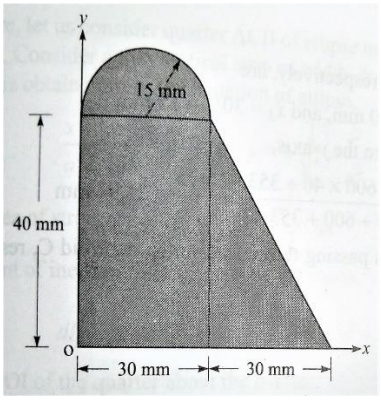
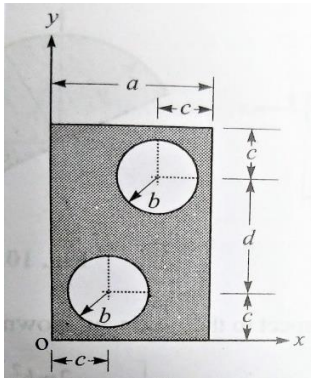
i. *There are three sections viz. Section A, Section B and Section C. Section A carries 20 marks, Section B carries 40 marks and Section C carries 40 marks*
ii. *Attempt all the questions in Section A, B and C*
iii. *Make appropriate assumptions wherever required*

SECTION A (5 x 4 = 20 Marks)

S. No.		Marks	CO
Q 1	Determine the maximum weight W of the sphere that can be supported in the position shown in the figure below, if each chain AB and AC can support a maximum force of 600 N before it fails. 	4	CO1
Q 2	Identify the zero-force members without calculation and give the reason for the same. 	4	CO3

Q.3	Acceleration of block A and B are related as:  	**4**	**CO2**
Q.4	A train starts from rest at station A and accelerates at 0.5 m/s^2 for 60 s. Afterwards it travel with a constant velocity for 15 min. It then decelerates at 1 m/s^2 until it is brought to rest at station B. Determine the distance between the stations.	**4**	**CO1**
Q.5	A simply supported beam AB is hinged at A and roller supported at B. This beam carries a uniformly variable load between end A and point C together with another uniformly distributed load between point C and end B as shown in the figure below. Determine the reactions at the hinge and roller supports.  	**4**	**CO2**
SECTION B (4 x 10 = 40 Marks)			
Q 5	Determine the acceleration and the tension of the cable when the blocks are released, Neglect the mass of the pulley.  	**10**	**CO3**
Q 6	The acceleration of a particle, which moves with rectilinear translation, is given by **a = (t-2)** m/s^2. At t = 0, the displacement (s) and velocity (v) are zero. (i) Find the velocity and displacement when t = 2 sec and when t = 4 sec. (ii) Show sketches of s, v and a for 0 < t < 4. (iii) Find average value of velocity and acceleration.	**10**	**CO2**

Q.7	Determine the maximum and minimum values of weight W which may be applied without causing the 15 Kg block to slip on inclned plane.The coefficent of statc frcton between the block and the plane is 0.25. Consider the pulley as frctionless.  **OR** A ladder 5 m 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 m from the bottom of the ladder. Calculate the coefficient of friction between the ladder and the floor.  	**10**	**CO2**
Q.8	A uniform bar AB of length ***l*** and weight ***W*** is resting against a smooth vertical wall at A and is supported at smooth knife-edge point D as shown in the figure below. If a downward vertical force ***F*** is applied at the end B, determine the angle **θ** for the equilibrium of the bar.  	**10**	**CO1**

SECTION C (2 x 20 = 40 Marks)			
Q 9	Find the forces in all the members of the truss as shown n figure.Also tabulate the results. 	**20**	**CO3**
Q.10	Determine the coordinates of the centroid of the composite area shown in the figure below with respect to origin. Also, determine the moment of inertia of this composite area about its centroidal x-axis.  **OR** Determine the coordinates of the centroid of the composite area shown in the figure below with respect to origin. Also, determine the moment of inertia of this composite area about its centroidal x-axis. Given a = 100 cm, b = 2.5 cm, c = 4.0 cm, and d = 10 cm. 	**20**	**CO3**