Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2019

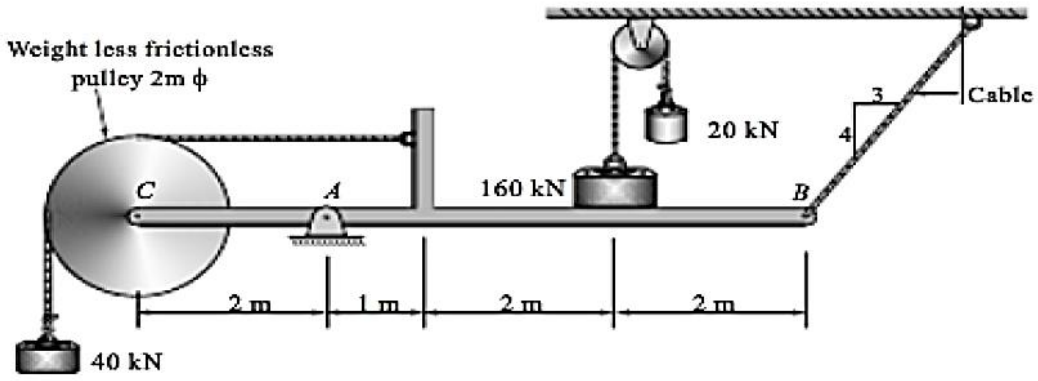
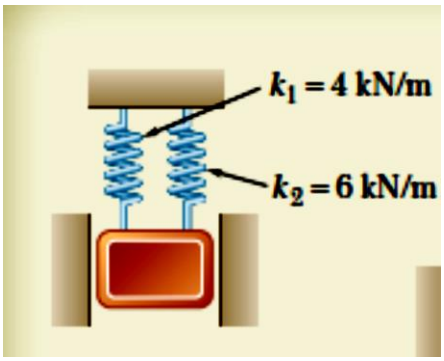
Course: Engineering Mechanics (MECH 2019) **Semester: III**

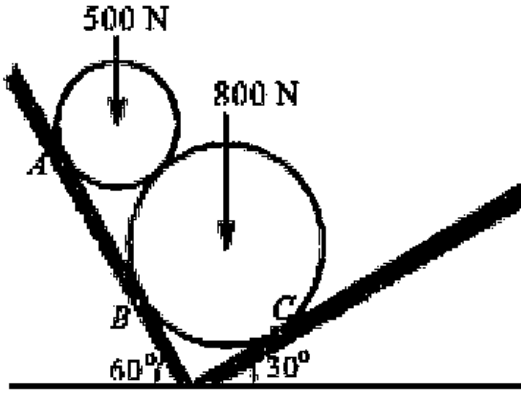
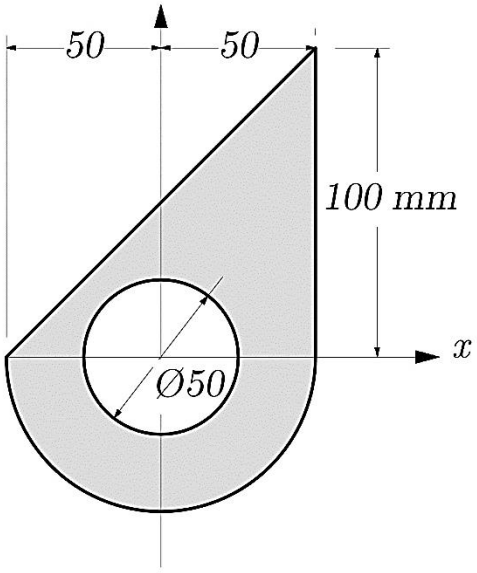
Programme: B.Tech Civil, Mechanical, Mechatronics, Electrical, APE Gas, CERP, **Time: 03 hrs.**

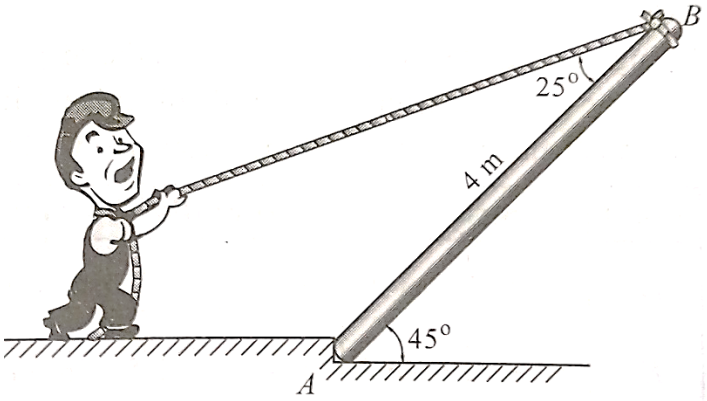
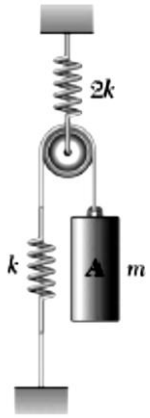
Max. Marks: 100

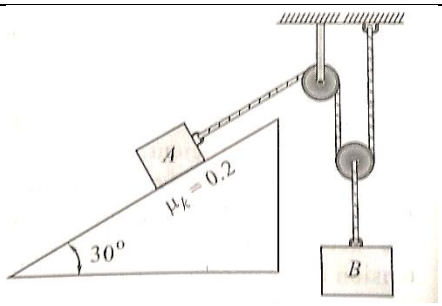
Instructions:

SECTION A

S. No.		Marks	CO
Q 1	State varignon's principle. Enlist its applications.	**4**	**CO1**
Q-2	Draw the FBD of the beam shown into the figure 	**4**	**CO1**
Q-3	Motion of particle is defined by $X= 6t^2-8+40\cos\pi t$ where x and t expressed in meters and seconds. Find position, velocity and acceleration when t = 6 seconds	**4**	**CO1**
Q-4	State the principle of virtual work. Show the applications of principle of virtual work.	**4**	**CO1**
Q-5	Find the natural frequency of vibration for the spring and mass system shown below 	**4**	**CO1**

SECTION B			
Q-6	Two smooth cylinders with diameter 250 mm and 400 mm respectively. Are kept in a groove with the slanting surfaces making an angle of $60^0$and 30^0 respectively. Determine reactions at contact point A and B 	**10**	**CO2**
Q-7	Derive the expression for lifting, lowering and self-locking of weight in simple screw jack.	**10**	**CO1**
Q-8	Find the moment of inertia of shaded area with respect to centroidal horizontal axis. 	**10**	**CO2**
Q-9	A boy throws a ball so that it may just clear a wall of 3.6m height. The boy is at a distance of 4.8m from the wall. The ball was found to hit the ground at a distance of 3.6 m on the other side of the wall. Find the least velocity with which the ball can be thrown.	**10**	**CO-3**

	OR A car accelerates from the rest at a constant rate of α for some time after which it decrease at a constant rate of β to come to rest. If the total time is t seconds evaluate i) maximum velocity reached and ii) total distance travelled.		
	SECTION-C		
Q-10	a) A man raises a 10 kg joist of length 4m by pulling on rope shown in figure. Find the tension in the rope using principle of virtual work.  b) Block A of mass m is supported by the spring arrangement as shown. Knowing that the mass of the pulley is negligible and that the block is moved vertically downward from its equilibrium position and released, determine the frequency of the motion.  	**20**	**CO3**
11	A block A of mass 400kg is being pulled up the inclined plane by using another block B of masses 800 kg as shown in figure. Determine the acceleration of block B and tension in rope pulling the block A. Take coefficient of friction between the block and the plane as 0.2.	**20**	**CO3**



OR

Masses A (5 kg), B (10 kg) and C (20kg) are connected as shown in the figure by inextensible cord passing over massless and frictionless pulleys. The coefficient of friction for masses A and B with the ground is 0.2. if the system is released from the rest find the tensions in the cord and acceleration of the blocks.