Name: **Enrolment No:**	UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
Special End Semester Examination, January 2020

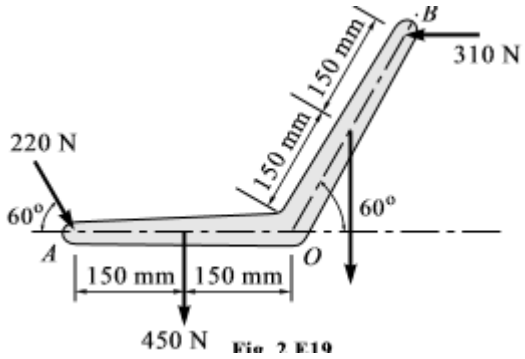
Course: Engineering Mechanics (MECH 2019) **Semester: III**

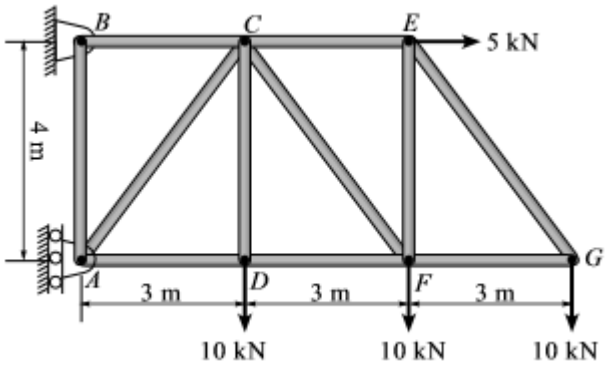
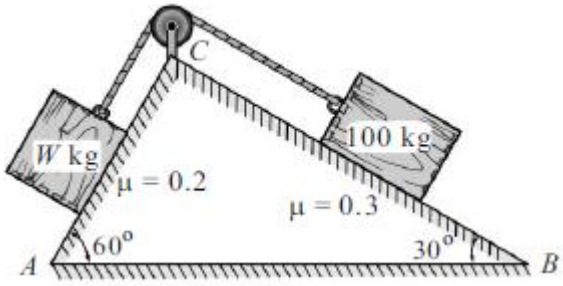
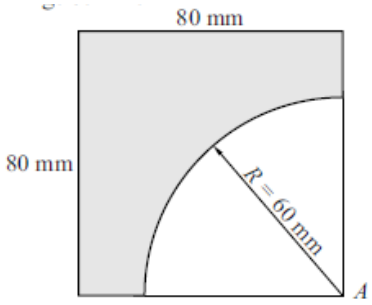
Program: B. Tech APE gas, CERP, Mechanical, Mechatronics, Electrical, Civil

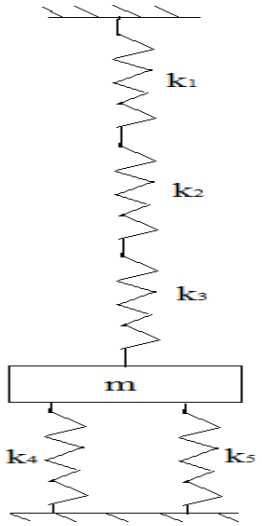
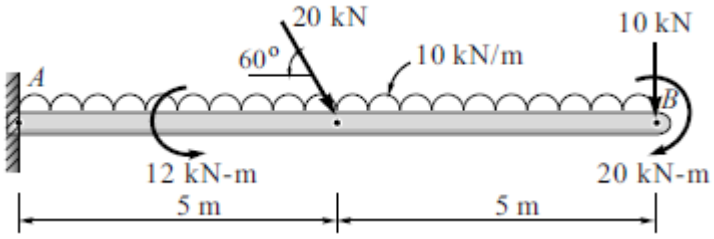
Time: 3 Hours **Max. Marks: 100**

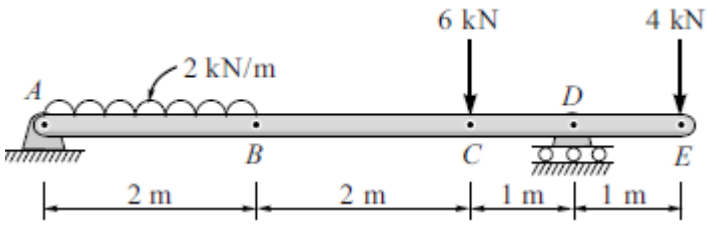
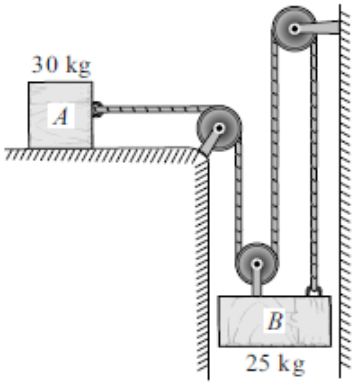
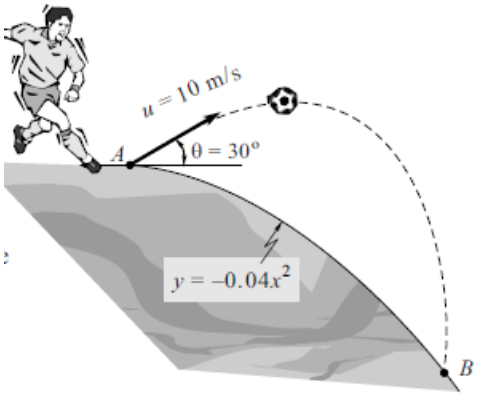
SECTION A

Note: For Q-1 to Q-4, Type the final answer only.

S. No.		Marks	CO
Q-1	Marks true of false for given statement a) Varignons principle is only applicable for two force system b) Free vibration can be represented by mass and spring system. c) Limiting friction is a maximum value of friction under static condition. d) Projectile is type of general plane motion. e) A truss with 5 joint and 7 members is an imperfect truss.	5	CO1
Q-2	Determine the resultant of the forces acting on the bell crank shown in the figure. Also mention its angle with positive x axis.  Fig. 2 E19	5	CO1
Q-3	Describes the steps of method of section for analysis of truss.	5	CO1
Q-4	Explain various types of loads used in engineering mechanics.	5	CO1
Q-5	Write the area moment of inertial of circle about the horizontal and vertical axis tangent to its circumference. (In terms of diameter of the circle).	5	CO1
Q-6	Describe free, forced and damped vibration with the help of real life examples.	5	CO1

SECTION B			
Q-7	For the truss shown find the force in the member CE and CF.  	**10**	**CO2**
Q-8	Two inclined planes AC and BC inclined at 60^0 and 30^0 to the horizontal meet at a ridge C, as shown in figure. A mass of 100 kg rests on the inclined plane BC and is tied to a rope, which passes over a smooth pulley at the ridge, the other end of the rope, being connected to a block of W kg mass resting on the plane AC. Determine the greatest value of W for the equilibrium of the whole system.  	**10**	**CO2**
Q-9	Locate the coordinates of the centroid of the plane area shown in the figure below. Also, determine the moment of inertia of the plane area about its centroidal axis horizontal and vertical axis.  	**10**	**CO2**

Q-10	The acceleration of a particle is given by $a = 0.02v^{1.75}$ m/s performing rectilinear motion. Knowing at x = 0, v = 15 m/s. Determine (a) the position where velocity is 14 m/s (b) the acceleration when x = 100 m. **OR** For the system shown in Figure below, k_1 = 3000 N/m, k_2 = 1500 N/m, k_3 = 4000 N/m and $k_4 = k_5$ = 100 N/m. Find 'm' such that the system has a natural frequency of 25 Hz. 	**10**	**CO3**
Q-11	Determine the reactions at all the supports of the beam shown in Figure.  **OR** A simply supported beam AE is loaded as shown in figure below. Determine the manitude of reactions at supports using **Virtual Work**.	**10**	**CO2**

			
SECTION C			
Q 12	The two blocks shown in figure are connected as shown. Neglecting the masses of the pulleys and the effect of friction in the pulleys and between block A and the horizontal surface, determine (a) the acceleration of each block and (b) The tension in the cable.  **OR** An object is projected with u = 10 m/s and θ= 30^0 from point A, as shown in Figure. Find the velocity with which it lands at B. Assume the ground has the shape of parabola as shown. 	**20**	**CO3**