PAPER ID-411905

Roll No: | | | | | | | | | | | | | |

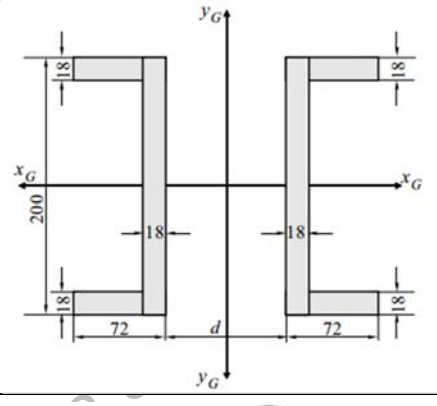
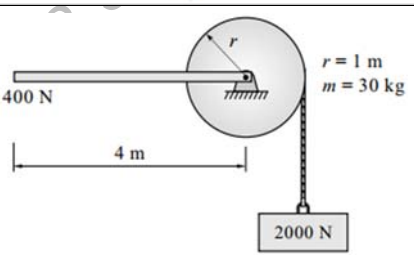
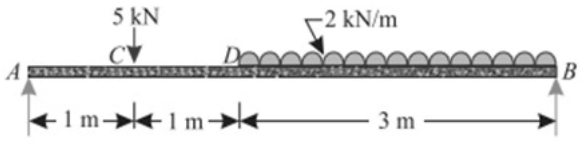
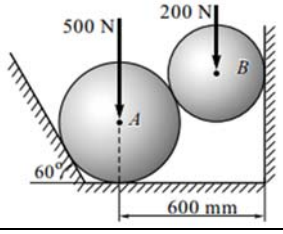
BTECH
(SEM III) THEORY EXAMINATION 2021-22
ENGG. MECHANICS

Time: 3 Hours ***Total Marks: 100***

Notes:

- *Attempt all Sections and Assume any missing data.*
- *Appropriate marks are allotted to each question, answer accordingly.*

SECTION-A	Attempt **All** of the following Questions in brief	Marks **(10X2=20)**	**CO**
Q1(a)	Write down the different types of supports and loading system.		3
Q1(b)	Define work and power. Write the mathematical relation and SI unit.		4
Q1(c)	Define center of mass and write down the coordinates of center of gravity of triangle.		2
Q1(d)	What is the difference between colinear and concurrent forces?		1
Q1(e)	Write down D'Alembert's Principle.		5
Q1(f)	A body of weight 50N placed on a horizontal surface is just moved by a force of 29N. Find the frictional force and normal reaction.		1
Q1(g)	What do you understand by point of contraflexure?		3
Q1(h)	Discuss the merits and demerits of friction.		1
Q1(i)	Calculate the bending moment at centre of a simply supported beam carrying a point load.		3
Q1(j)	Two spheres of weight P and Q rest inside a hollow cylinder which is resting on a horizontal force. Draw the free body diagram of both the spheres, together and separately.		1

SECTION-B	Attempt **ANY THREE** of the following Questions	Marks **(3X10=30)**	**CO**
Q2(a)	Two channels are kept as shown in given figure, at a distance d between them to form the cross section of a column. Find the value of the distance 'd' if the centroidal moment of inertia I_x and I_y of the area are equal. 		2
Q2(b)	A uniform rod 4 m long weighing 400 N is rigidly connected to the centre of a cylinder of mass 30 kg, as shown in given figure.The diameter of cylinder is 2 m. Find the linear acceleration of block weighing 2000 N connected to the cylinder by an inextensible string. 		5
Q2(c)	Explain the principle of virtual work. A simply supported beam AB of span 5 m is loaded as shown in given figure, Using the principle of virtual work, find the reactions at A and B. 		3
Q2(d)	State and prove Lami's theorem. Two spheres, A and B, are resting in a smooth through as shown in given figure. Draw the free body diagrams of A and B showing all the forces acting on them, both in magnitude and direction. Radius of spheres A and B are 250 mm and 200 mm, respectively. 		1

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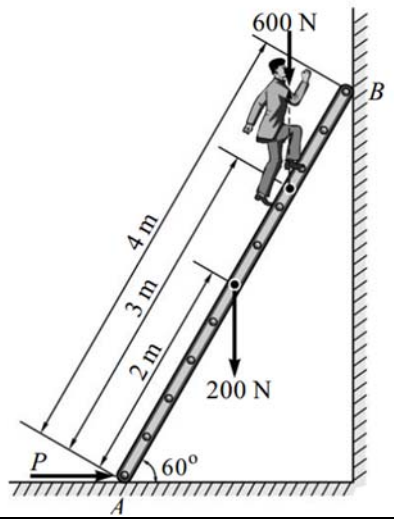
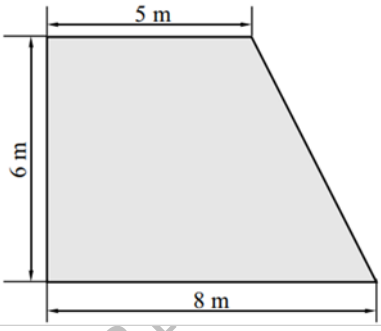
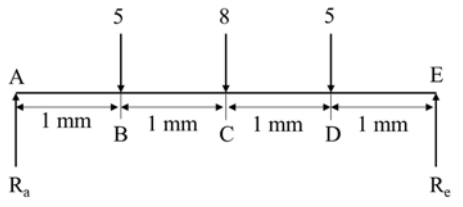
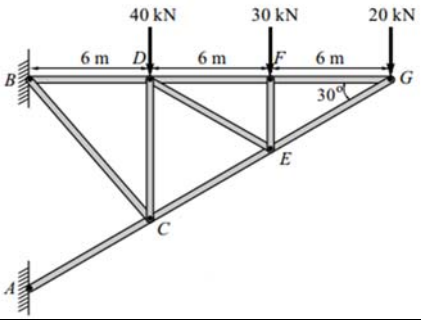
Q2(e)	Differentiate between rectilinear and curvilinear motion. Also derive the expression for the Horizontal Range, Time of flight and maximum height of a projectile with initial velocity 'u' and inclined at an angle "α" with the horizontal.	4

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q3(a)	A ladder of length 4 m weighing 200 N is placed against a vertical wall, as shown in given figure. The coefficient of friction between the wall and the ladder is 0.2 and that between the ladder and the floor is 0.3. The ladder in addition to its own weight has to support a man weighing 600 N at a distance of 3 m from A. Calculate the minimum horizontal force to be applied at A to prevent slipping. 		1
Q3(b)	Define the centre of gravity and centroid. Find the centroid of the shaded area in given figure 		2

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q4(a)	Draw the SF and BM diagram for the simply supported beam loaded as shown in given figure. 		3
Q4(b)	Find the forces in the members DF, DE, CE and EF by method of joints only for the pin-jointed frame shown in given figure. 		3

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	**CO**
Q5(a)	State Work Energy principle. A uniform cylinder of 125mm radius has a mass of 0.15 kg. This cylinder rolls without slipping along a horizontal surface with a translation velocity of 20cm/sec. Determine its total kinetic energy.		4

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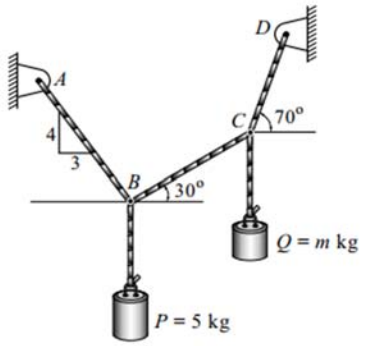
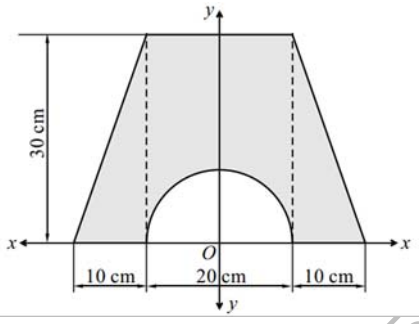
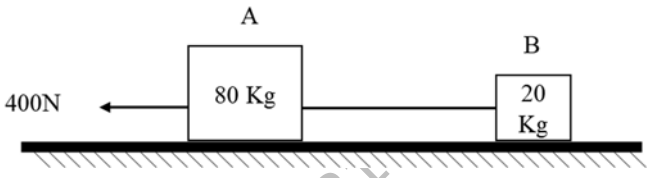
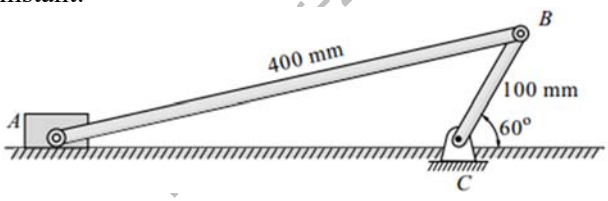
Q5(b)	Block P of mass 5 kg and block Q of mass 'm' kg are suspended through the chord, which is in the equilibrium position, as shown in given figure. Determine the mass of block Q. 	1

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	CO
Q6(a)	Derive an equation for moment of inertia of triangle centroidal axis and about its base.		2
Q6(b)	Find the moment of inertia of shaded area shown in given figure, about x-x axis and y-y axis. 		2

SECTION-C	Attempt **ANY ONE** following Question	Marks **(1X10=10)**	CO
Q7(a)	Two bodies A and B of mass 80 kg and 20 kg are 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 given figure. The coefficient of friction between the sliding surfaces of the bodies and the plane is 0.3. Determine the acceleration of the two bodies and the tension in the thread, using D' Alembert's principle. 		5
Q7(b)	The crank BC of a slider crank mechanism is rotating at constant speed of 30 rpm, as shown in given figure clockwise. Determine the velocity of the cross-head A at the given instant. 		5