Reg No.:_____ Name:_____

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

First Semester B.Tech Degree Regular and Supplementary Examination December 2023 (2019 scheme)

Course Code: EST 100

Course Name: ENGINEERING MECHANICS

(2019 -Scheme)

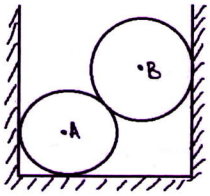
Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks Marks

1 Explain superposition law and law of transmissibility. (3)

2 Two smooth identical spheres A and B are placed in a rectangular channel as shown in figure. Draw the free body diagram of each sphere. (3)

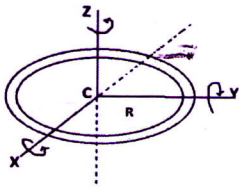


3 Distinguish between static friction and dynamic friction. (3)

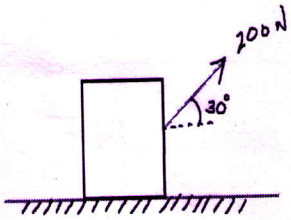
4 A simply supported beam AB of span 5m is carrying point loads 4N, 3N & 5N at 2m,3m & 4m respectively from support A. Calculate reactions at supports A and B. (3)

5 State and prove parallel axis theorem. (3)

6 Determine the mass moment of Inertia of a ring about ZZ axis. Density of material – ρ (3)



7 A 25 kg body rests on a horizontal surface for which coefficient of kinetic friction is $\mu_k = 0.3$. If the body is subjected to a 200 N force as shown below, determine the acceleration of the body. (3)



8 A body is projected at an angle such that its horizontal displacement is 2 times that of maximum height. Find the angle of projection. (3)

9 Explain instantaneous centre of zero velocity. How can you locate it? (3)

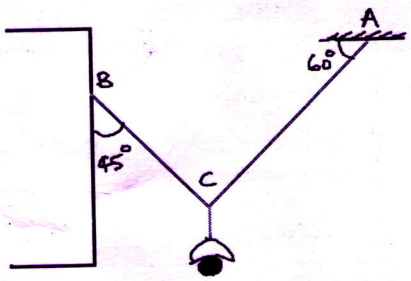
10 A block of mass 50 kg supported by two springs connected in series hangs from the ceiling. The stiffness of two springs are 4 kN /m and 6 kN /m. Find the equivalent stiffness. (3)

PART B

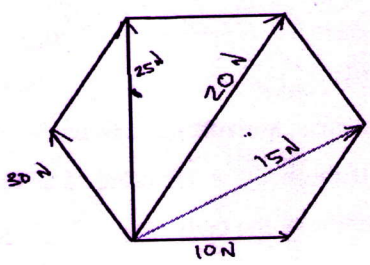
Answer one full question from each module, each question carries 14 marks.

MODULE 1

11 a An electric light fixture weighing 15 N hangs from a point C, by two strings AC and BC as shown in figure. Determine tension in the strings AC and BC. (7)

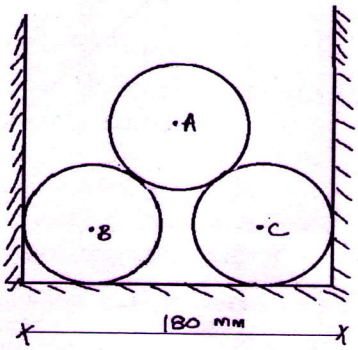


b Forces of 10N, 15N, 20N, 25N and 30N act at an angular point of a regular hexagon towards other angular points as shown in figure. Calculate the magnitude and direction of the resultant force. (7)



12 Three cylinders weighing 100N each and of 80 mm diameter are placed in a channel of 180mm width as shown in figure. Determine the force exerted by (14)

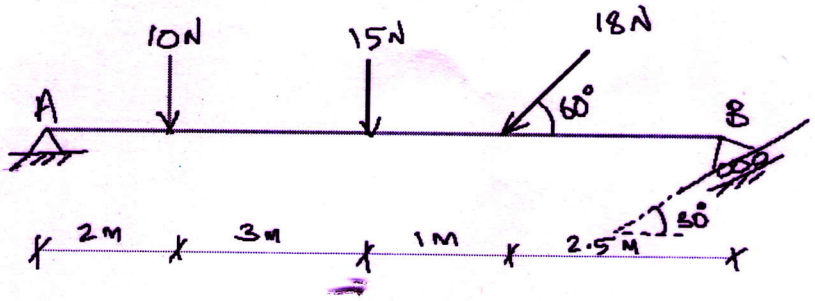
(i) cylinder A on B at the point of contact. (ii) cylinder B on base (iii) cylinder B on wall.



MODULE 2

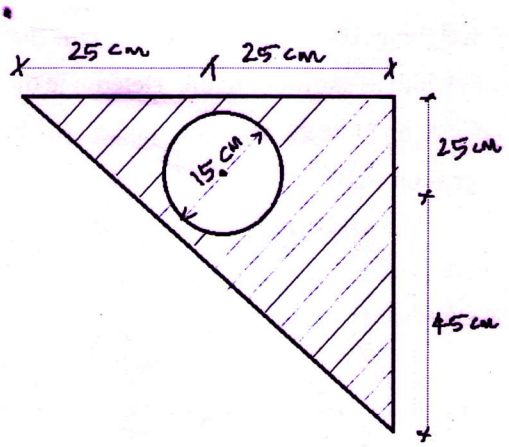
13 A block weighing 1000 N, overlying a 15° wedge on a horizontal floor and leaning against a vertical wall, is to be raised by applying a horizontal force to the wedge. Assuming the coefficient of friction between all the surface in contact to be 0.3, determine the minimum horizontal force required to raise the block. (14)

14 A beam is hinged at A and roller supported at B. It is acted upon by loads as shown below. Find the reactions at A & B. (14)

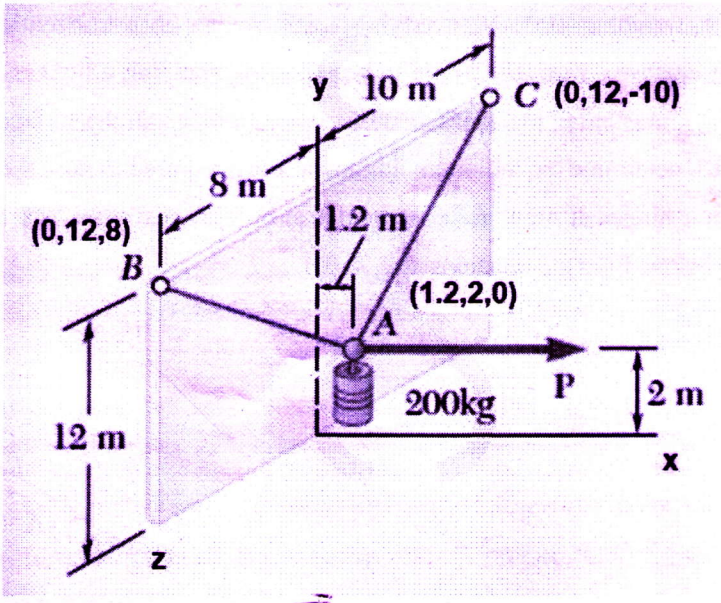


MODULE 3

15 Calculate the moment of Inertia of the shaded area shown in fig, w.r.t. centroidal axes. (14)

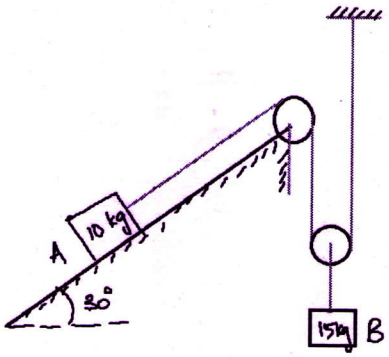


16 A 200-kg cylinder is hung by means of two cables AB and AC, which are attached to the top of a vertical wall. A horizontal force P perpendicular to the wall holds the cylinder in the position shown. Determine the magnitude of P and the tension in each cable. (14)



MODULE 4

17 Determine the resulting motion of the body A of mass 10 kg assuming the pulleys to be smooth and weightless as shown in Fig. If the system starts from rest, determine the velocity of the body A after 10 seconds. Given coefficient of friction as 0.2 and mass of B as 15 kg. (14)



18 Find the least initial velocity which a projectile may have so that it may clear a wall 3.6m high and 4.8m distant (from point of projection) and strike the horizontal plane through the foot of wall at a distance 3.6 m beyond the wall. Point of projection is at same level as foot of the wall. (14)

MODULE 5

19 A flywheel rotates with a constant retardation due to braking. In the first 10 seconds, it made 300 revolutions. At time t = 7.5 sec, its angular velocity was 40 π rad/sec. Determine (i) value of constant retardation ; (ii) total time taken to come to rest and (iii) total revolutions made till it comes to rest. (14)

20 A solid cylindrical pulley of mass 800kg, having 0.8m radius of gyration and 2m diameter is rotated by an electric motor, which exerts a uniform torque of 60kNm. A body of mass 3t is to be lifted by a wire wrapped round the pulley. Find: i) Acceleration of the body & ii) Tension in the rope (14)

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