Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

First Semester B.Tech Degree Examination December 2021 (2019 scheme)

**Course Code: EST100**

**Course Name: ENGINEERING MECHANICS**

**(2019 -Scheme)**

Max. Marks: 100 Duration: 3 Hours

**PART A**

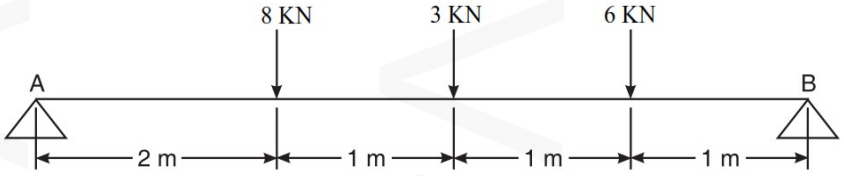
***Answer all questions, each carries 3 marks*** Marks

1 List out and explain systems of forces. (3)

2 State & Explain the Varignon's theorem (3)

3 Define coefficient of friction. Show that the coefficient of friction is tangent of the angle of friction (3)

4 Find the reactions at A and B (3)




5 Discuss the generation of area by theorem of Pappus Guldinus (3)

6 State and explain parallel axis theorem. (3)

7 Discuss the use of D-Alembert's principle used for the analysis of a moving rigid body (3)

8 A stone is dropped from the top of a tower 70 m high. At the same time another stone is thrown up from the foot of the tower with a velocity of 30 m/s. At what distance from the top and after how much time the two stones cross each other? (3)

9 What do you mean by instantaneous centre of rotation? How can it be located for a body moving with combined motion of rotation and translation? (3)

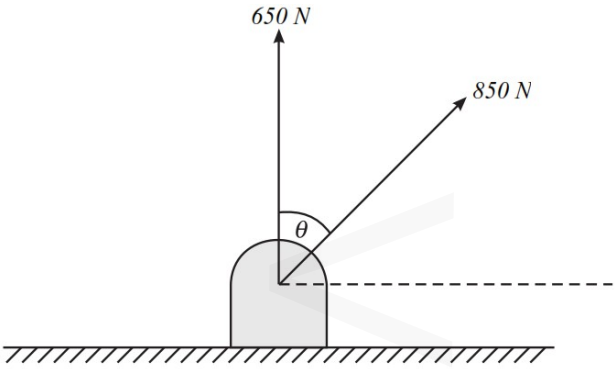
10 What do you mean by general plane motion? Give two examples of bodies performing combined motion of rotation and translation (3)

**PART B**

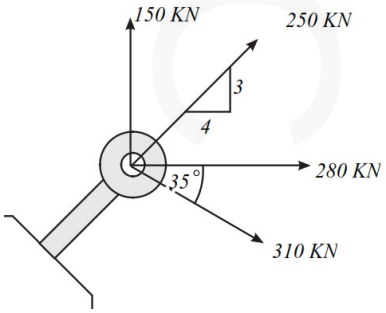
***Answer one full question from each module, each question carries 14 marks.***

**MODULE 1**

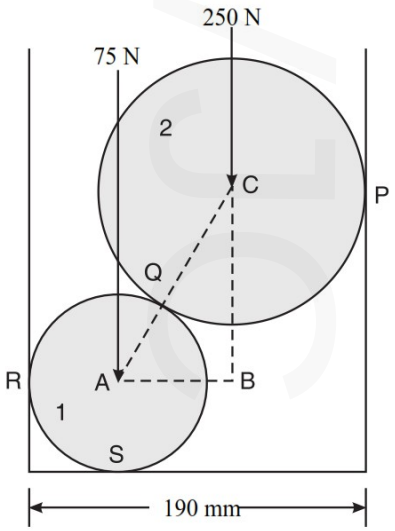
11 a Determine angle between the forces and the direction of the resultant shown in figure. The resultant of the two forces is 1300 N. (7)




11 b Four forces are acting on a bolt as shown in Figure 3.10. Determine the magnitude and direction of the resultant force (7)

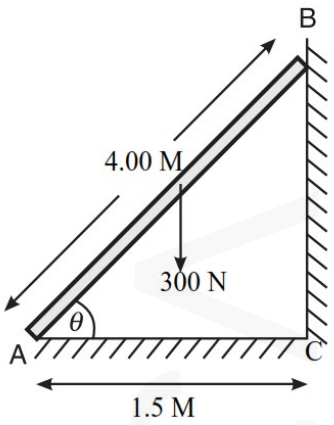



12 Determine the reactions at contact points P, Q, R, and S for the system shown in Figure. The radii of spheres 1 and 2 are, respectively, 40 mm and 60 mm. (14)



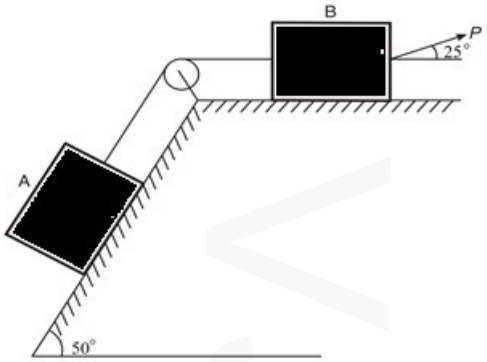

## MODULE 2

13 a A uniform ladder AB of length 4.00 m and weighing 300 N is placed against a smooth wall with its lower end 1.50 m from the wall. The coefficient of friction between the ladder and the floor is 0.25. What is the frictional force acting at the point of contact between the ladder and the floor? Show that the ladder will remain in equilibrium in this position. (7)



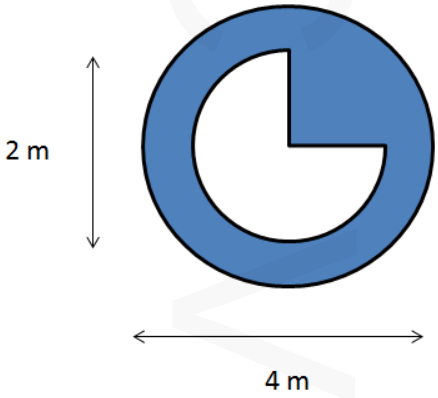

13 b Explain angle of friction and angle of repose. Show that angle of repose is equal to angle of friction. (7)

14 Two blocks A and B weighing 6 kN and 3.5 kN, respectively, are connected by a wire passing over a smooth frictionless pulley as shown in Figure. Determine the magnitude of force P which is applied on block B at 25° from horizontal as shown in figure. Take $\mu = 0.20$. (14)

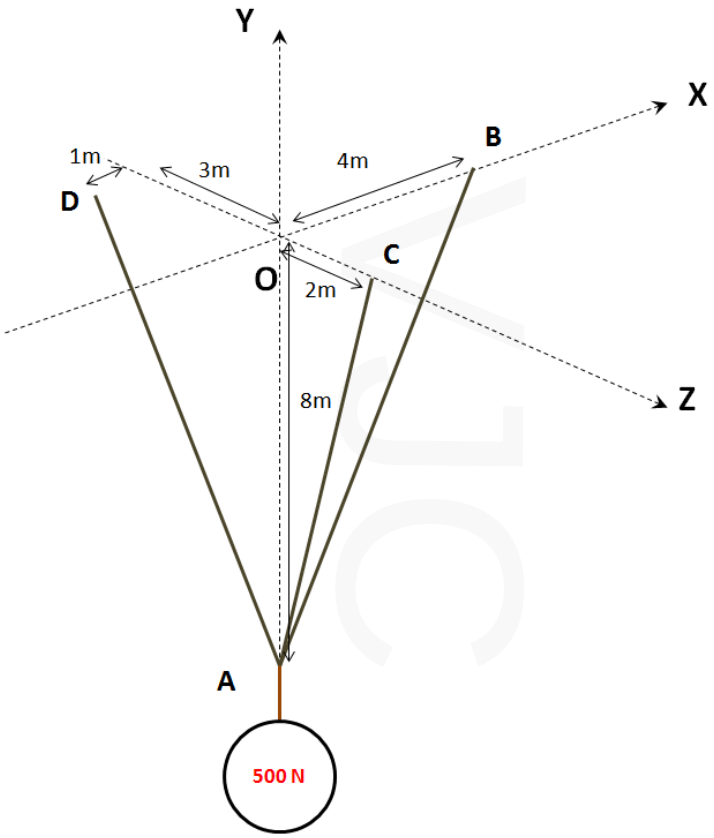



**MODULE 3**

15 From a circular lamina of diameter 4m, 3/4th quarter circle of diameter 2m has been remove from the centre. Determine the moment of inertia of the resulting composite figure about the centroidal X axis. (14)

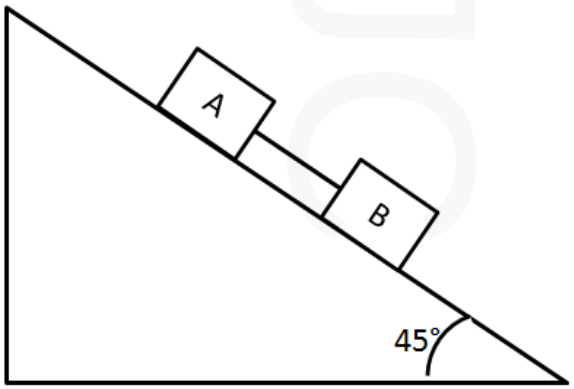



16 Three cables support a weight of 500 N at point A as shown in the figure. Determine the tension in the cables. (14)




**MODULE 4**

17 a Two masses $M_A$ = 20 kg and $M_B$ = 10 kg are connected by a bar of negligible mass. Find the acceleration of the system when it slides down an inclined plane of inclination 45° as shown in figure. Also find the force in bar. Assume $\mu_A$= 0.2 and $\mu_B$=0.4. (10)




17 b A car moving at a speed of 60kmph, when the brakes are fully applies causing all four wheel to skid. Determine the time required to stop the car. The coefficient of friction between the road and tyre is 0.3. Weight of the car 50kN. (4)

18 a A block of weight 50N is moving over a horizontal surface starting at rest, moves over a distance of 25m in 10 seconds under the action of a force of 20N. Determine the coefficient of friction between the surfaces. (7)

18 b A car starts from rest on a curved road of radius 250 m and attains a speed of 18 km/hour at the end of 60 seconds while travelling with a uniform acceleration. Find the tangential and normal accelerations of the car 30 seconds after it started. (7)

**MODULE 5**

19 a A particle moving with simple harmonic motion has velocities of 8 m/s and 4 m/s when at the distance of 1 m and 2 m from the mean position. Determine (i) amplitude, (ii) period, (iii) maximum velocity, and (iv) maximum acceleration of the particle. (7)

19 b A weight of 50 N suspended from a spring vibrates vertically with an amplitude of 7.5cm and a frequency of 1oscillation /second. Find the stiffness of the spring and the maximum tension induced in the spring (7)

20 a A weight of 4 N is suspended by a light rope wound round a pulley of weight 48 N and radius 25 cm, the other end of the rope being fixed to the periphery of the pulley. If the weight is moving downwards, determine: (7)

(i) Acceleration of the weight 4 N, and

(ii) Tension in the string. Take g = 9.80 m/s².

20 b A wheel, rotating about a fixed axis at 30 r.p.m. is uniformly accelerated for 50 seconds, during which time it makes 40 revolution. Find: (i) angular velocity the end of this interval, and (ii) time required for the speed to reach 80 revolution per minute. (7)

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