Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree Regular and Supplementary Examination June 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

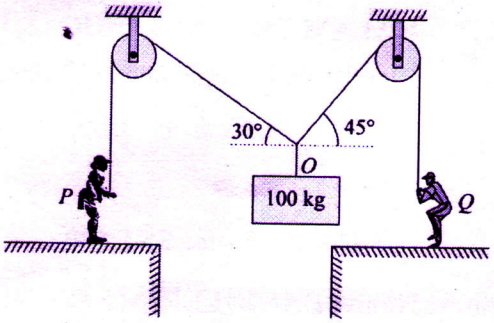
1		State and explain parallelogram law of forces.	(3)
2		A simply supported beam AB of span 6m is carrying point loads 10kN & 20kN at 2m & 4m respectively from support A. Calculate reactions at supports A and B.	(3)
3		Explain Coulomb's law of friction.	(3)
4		Calculate the moment of inertia of rectangular cross section of breadth b and depth d about the centroidal horizontal axis.	(3)
5		State and explain Varignon's theorem of moments.	(3)
6		Explain radius of gyration of an area.	(3)
7		Explain D'Alembert's principle.	(3)
8		Explain work energy principle in dynamics.	(3)
9		Distinguish damped and undamped free vibrations.	(3)
10		A particle executing SHM passes through two points P and Q that are 20cm apart with the same velocity in a time interval of 4 seconds. If the particle returns to Q after another 2 seconds, find the period and amplitude of motion.	(3)

PART B

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

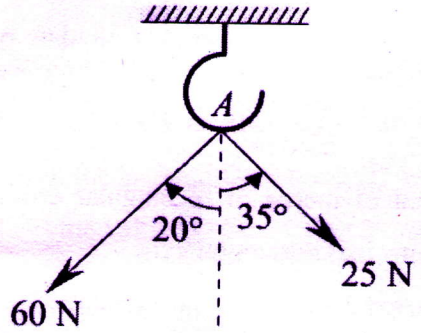
MODULE 1

11	a.	Two persons lift a mass of 100 kg by cables passing over two pulleys as shown in Fig. Determine the forces P and Q that must be applied by the two persons if the body is in equilibrium at the position shown.	(9)

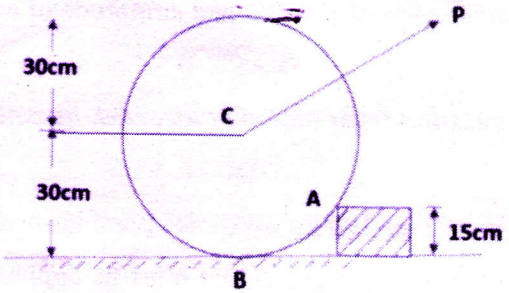


b. The greatest and least resultants of two forces F1 and F2 are 17N and 3N respectively. Determine the angle between them when their resultant is 149N. (5)

12 a Two forces are applied at the point A of a hook support as shown in Fig. Determine the magnitude and direction of the resultant force. (5)

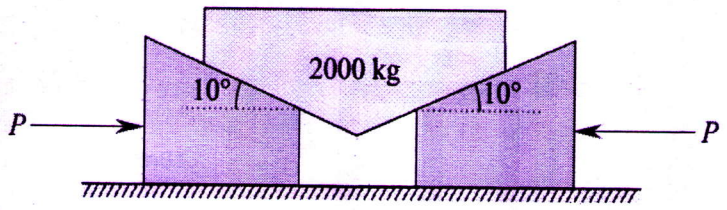


b A uniform wheel 60cm diameter weighing 1000N rests against a rectangular obstacle 15cm height as shown in figure. Find the least force required, which when acting through the centre of the wheel will just turn the wheel over the corner A of the block. Also find the reaction of the block. (9)

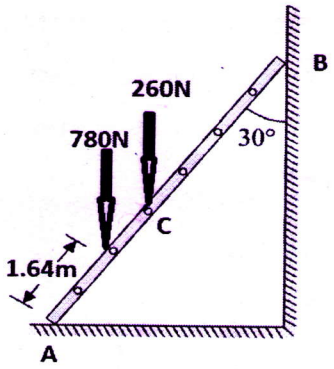


MODULE 2

13 A 2000 kg block must be raised using two similar wedges as shown in Fig. What horizontal force P must be applied on both the wedges to raise the block? Take coefficient of friction at all contact surfaces as 0.2. (14)

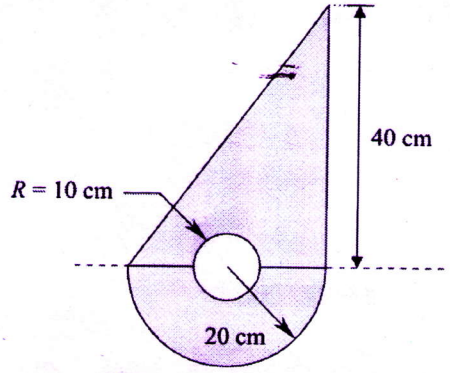


14 a A ladder 5m long and weighing 260N, is placed against a vertical wall at an inclination of 30° with the wall. A man weighing 780N climbs the ladder. When he is at a distance of 1.64m along the ladder from the lower end, the ladder slips. What is the reaction at wall, floor and coefficient of friction assuming the same for all contact surfaces. (14)



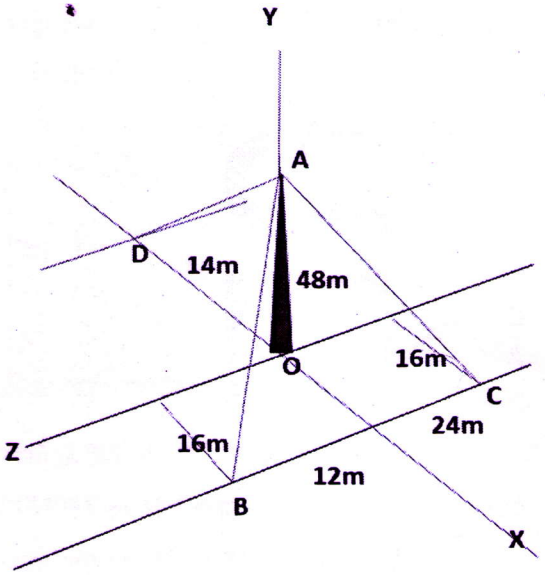
MODULE 3

15 Find the moments of inertia of the shaded area about the centroidal axes (14)



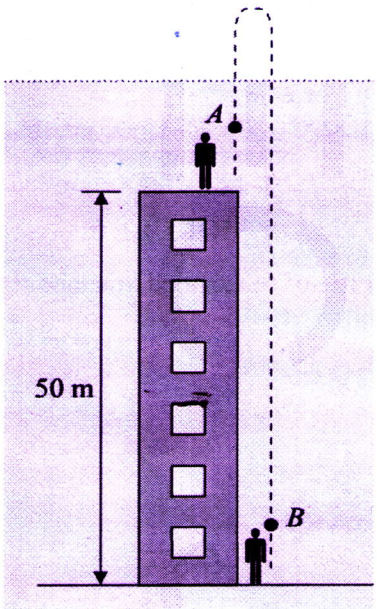
16 A post is held in vertical position by three cable AB, AC and AD as shown in fig. If the tension in the cable AB is 40N, calculate the required tension in AC and (14)

AD so that the resultant of the three forces applied at A is vertical.

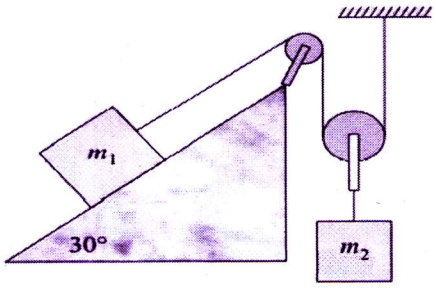


MODULE 4

17 A ball is thrown upwards from the top of a 50 m high building with an initial velocity of 20 m/s. At the same instant, another ball is thrown upwards with an initial velocity of 30 m/s from the ground. Determine (i) when and where they will meet each other, and (ii) the velocity of each ball at that instant. (14)

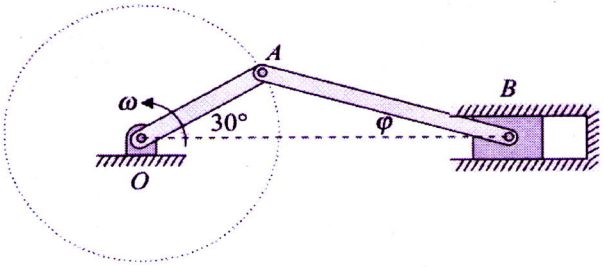


18 Determine the acceleration of the system of the blocks shown in Fig. The coefficient of kinetic friction between the block 1 and the inclined plane is 0.15. Also, determine the tension in the string. Take m1 = 75 kg, m2 = 50 kg. (14)

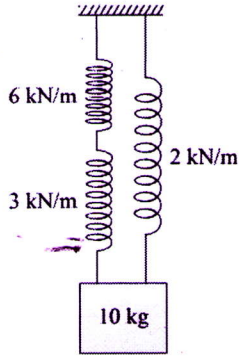


MODULE 5

19 A reciprocating engine mechanism is shown in Fig, in which the crank OA rotates at a constant angular velocity of 1200 rpm in the anticlockwise direction. For the position shown, determine (i) the angular velocity of the connecting rod AB, and (ii) the velocity of piston in the engine. Take OA = 10 cm, AB = 25 cm. (14)



20 a A 10 kg block is suspended by a system of three springs as shown. The respective spring constants are also shown in Fig. Determine the period of oscillation for small displacement from the equilibrium position. (6)



b A passenger car is travelling at 65 kmph on a level road. The distance from the road to the centre of the wheel is 30cm. Determine (8)

(i) The magnitude of angular velocity of the wheels

(ii) The magnitude of the constant angular deceleration of the wheels, if the car is brought to rest in 150m.

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