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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Second Semester B.Tech Degree (S, FE) Examination January 2024 (2019 Scheme)

Course Code: EST 100

Course Name: ENGINEERING MECHANICS

(2019 -Scheme)

Max. Marks: 100 Duration: 3 Hours

PART A

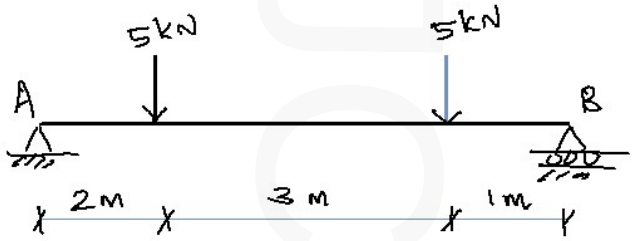
Answer all questions, each carries 3 marks Marks

1 Define the free body diagram of a body in an equilibrium system, and explain its importance. (3)

2 A right triangle ABC has its side AB = 40 mm along positive x-axis and side BC = 30 mm along positive y-axis. Three forces of 40 N, 50 N and 30 N act along the sides AB, BC and CA respectively. Determine magnitude of the resultant of such a system of forces. (3)

3 Define angle of friction, coefficient of friction and cone of friction. (3)

4 Calculate the reactions at A and B of the given loaded beam. (3)



5 Show that the moment of Inertia of a triangle with base B and height H about its axis passing through vertex opposite to its base is $\frac{BH^3}{4}$. (3)

6 State and explain Pappus-Guldinus theorems. (3)

7 A constant retarding force of 50 N is applied to a body of mass 20 kg moving initially with a velocity of 15 m/s. How long the body will take to stop? (3)

8 The equation of motion of an engine is given by $s = 2t^3 - 6t^2 - 5$, where (s) is in metres and (t) in seconds. Calculate displacement and acceleration when velocity is zero. (3)

9 Find the amplitude and time period of a particle moving with simple harmonic (3)

motion, which has a velocity of 9m/s and 4 m/s at a distance of 2m and 3m respectively from the centre.

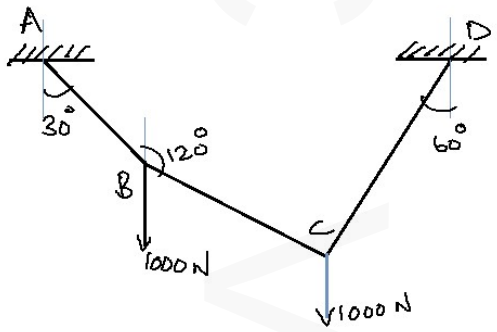
10 Explain the terms free vibration and forced vibration. (3)

PART B

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

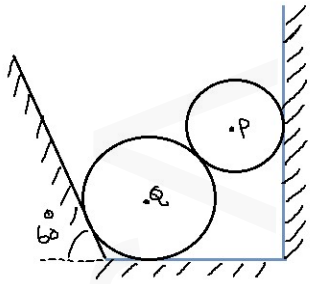
MODULE 1

11 a A string ABCD, attached to fixed points A and D has two equal weights of 1000 N attached to it at B and C. The weights rest with the portions AB and CD inclined at angles as shown in figure. Find the tensions in the portions AB, BC and CD of the string. (7)



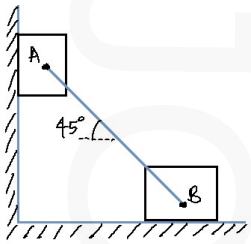
b Four forces equal to P, 2P, 3P and 4P are respectively acting along the four sides of square ABCD of side 'a' taken in order. Find the magnitude, direction and position of the resultant force. (7)

12 Two cylinders P and Q rest in a channel as shown in figure. The cylinder P has diameter of 100 mm and weighs 200 N, whereas the cylinder Q has diameter of 180 mm and weighs 500 N. If the bottom width of the box is 180 mm, with one side vertical and the other inclined at 60°, determine the pressures at all the four points of contact. (14)

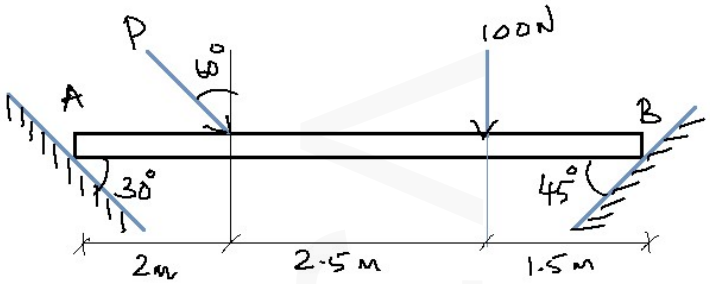


MODULE 2

13 Two identical blocks, A and B, of weight W are supported by a rigid bar inclined 45^0 with horizontal as shown in figure. If both the blocks are in limiting equilibrium, find the coefficient of friction, assuming it to be same at the floor and the wall. (14)

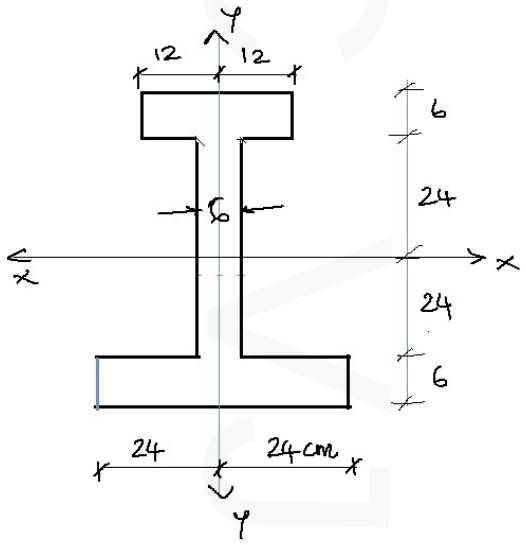


14 A 6m bar of negligible weight rests in a horizontal position on the smooth planes as shown in figure. Determine load P and reactions at supports. (14)

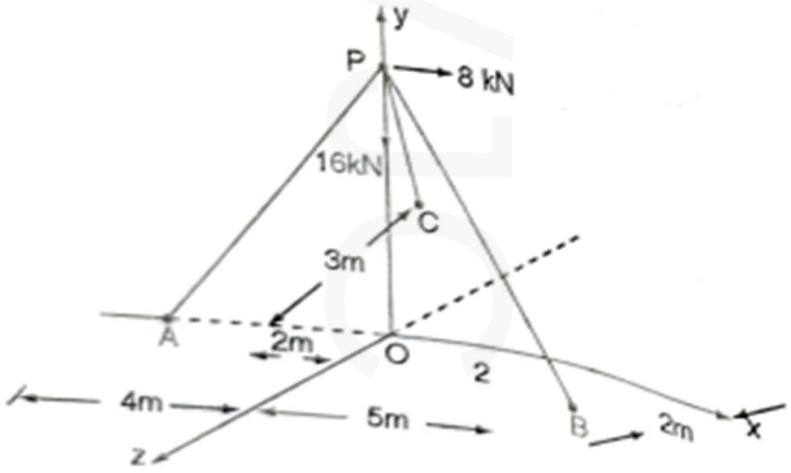


MODULE 3

15 Determine the moment of inertia of the given I section with respect to x and y axes. (14)

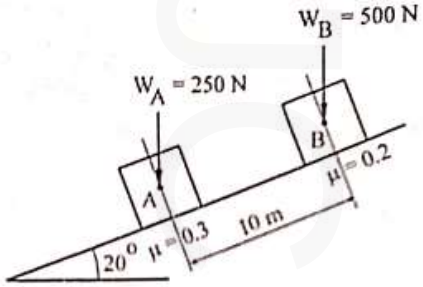


16 A tripod is acted upon by forces at P as shown in figure. Determine the forces in the leg of tripod if the legs on the ground at A, B and C whose coordinates w.r.to O in the figure. The height of P above the origin is 10m. (14)



MODULE 4

17 Two blocks A & B are held stationary 10m apart on a 20° incline as shown in fig. The coeff of friction between plane & block A is 0.3 and b/w plane and block B is 0.2. If the blocks are released simultaneously, calculate the time taken and the distance travelled by each block before they are at the verge of collision. (14)



18 A shot is fired with a velocity if 30 m/s from a point 15 metres in front of a vertical wall 6 metres high. Find the angle of projection, to the horizontal for the shot just to clear the top of the wall. (14)

MODULE 5

19 Two blocks of masses 10kg and 25 kg are attached to the two ends of a flexible rope. The rope passes over a pulley of diameter 500mm. The mass of the pulley is 7.5 kg and its radius of gyration is 200mm. Find the acceleration of masses and tension on either side of the rope. (14)

20 A particle is executing simple harmonic motion. Starting from rest, it travels a distance ‘a’ in first second and a distance ‘b’ in the next second in the same direction. Show that the amplitude is $\frac{2a^2}{3a-b}$. (14)

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