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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S1 (S, FE) S2 (S, FE) Examination December 2023 (2015 Scheme)

Course Code: BE 100
Course Name: ENGINEERING MECHANICS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 5 marks Marks

1 State and explain the Varignon's theorem for concurrent forces. (5)

2 Explain angle of friction and angle of repose. Show that angle of repose is equal to angle of friction. (5)

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

4 Using the principle of virtual work, determine the reaction of a simply supported beam AB of spam 10 m. The beam carries a point load of 5 kN at a distance of 4 m from A. (5)

5 State and explain the D-Alembert's principle and concept of dynamic equilibrium (5)

6 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? (5)

7 Discuss the terms: Free vibration, Forced vibration and Degree of freedom. (5)

8 For the simple harmonic motion, explain the terms: Amplitude, Period and Frequency. (5)

PART B

Answer any 2 questions from each SET, each question carries 10 marks.

SET I

9 Determine the reactions at the supports of the beam shown in Fig. 1 (10)

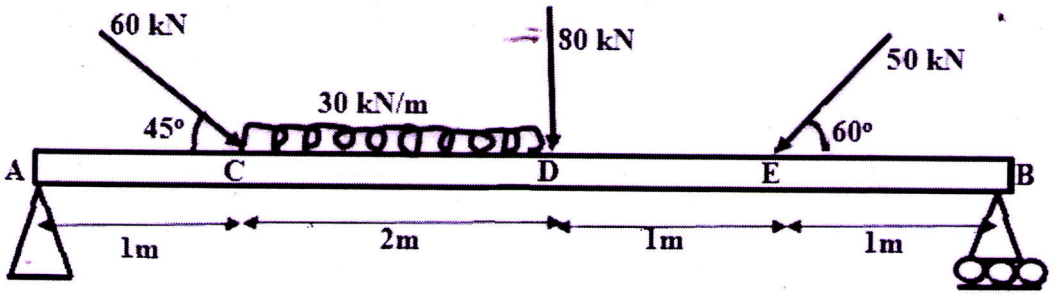

Fig. 1

10 Two identical rollers, as shown in Fig. 2. Find the reactions at the points of supports P, Q and R. Assume all the surfaces to be smooth. (10)

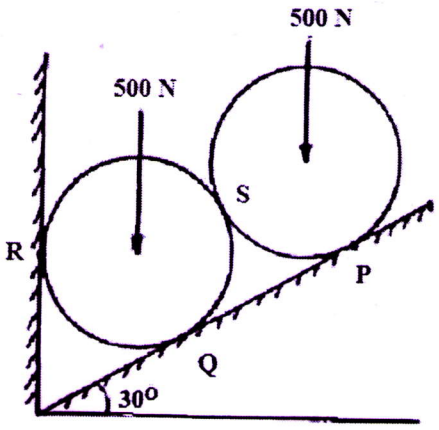

Fig. 2

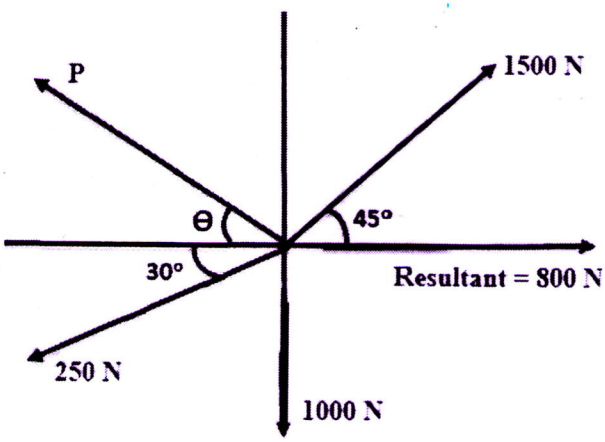

Fig. 3

11 The four coplanar forces as shown in Fig. 3 above. The resultant is having a magnitude 800 N and is acting along x- axis. Determine the unknown force P and its inclination with x-axis. (10)

SET II

12 A pull of 60N inclined at 25 degree to the horizontal plane, is required to just move the body placed on a rough horizontal plane. But the push required to move the body is 75N. If the push is inclined at 25 degrees to the horizontal, find the weight of the body and coefficient of friction. (10)

13 Find the moment of inertia of the section about the centroidal axes XX and YY shown in Fig. 4 and calculate the least radius of gyration. (10)

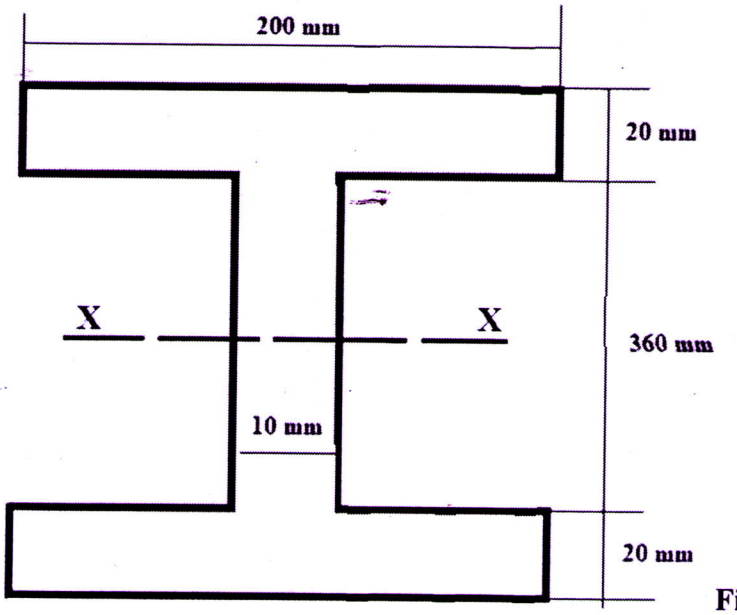

Fig .4

14 A ladder of 8 m long and 400 N weight is placed against a vertical wall. A man of weight 1000 N climbs the ladder. At what position he induce slipping? Take co-efficient of friction for both contact surfaces as 0.2. The ladder is inclined at 60 degrees to floor. (10)

SET III

15 A roller is in contact with two conveyor belts as shown in Fig. 5. If the belts run at the uniform speed of 8 m/s and 4 m/s, find linear velocity and angular velocity of the roller. (10)

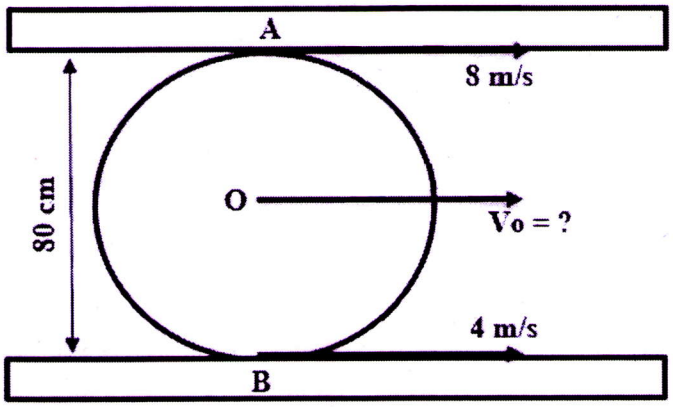

Fig. 5

16 A 100 kg block supported by two spring is hangs from the ceiling. The spring constant are 4000 N/m and 6000 kN/m. The block is pulled 50 mm down from its position of equilibrium and the released. Determine the period of vibrations, maximum velocity and acceleration of the block. (10)

a) Springs are connected in series

b) Springs are in parallel.

17 Two blocks of masses M_1 and M_2 are connected by a flexible but inextensible string as shown in Fig. 6. Assuming coefficient of friction between block M_1 and horizontal surface to be 0.25, find the acceleration of the masses and tension in the string. (10)

$M_1 = 10$ kg and $M_2 = 5$ kg.

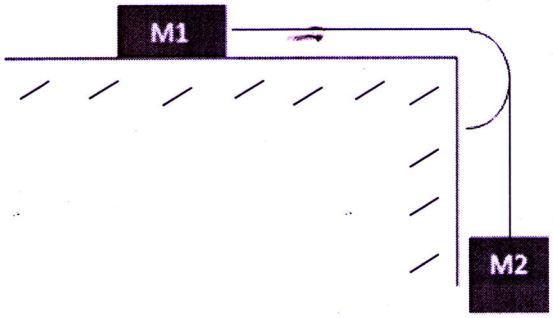

Fig. 6

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