Code No: 121AC

R15

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech I Year Examinations, March/April - 2023
ENGINEERING MECHANICS
(Common to CE, ME, AE, PTM)

Time: 3 hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART - A

(25 Marks)

1.a) State and explain Varignon's theorem? [2]
b) The greatest and least resultants of two forces F_1 and F_2 are 17 N and 3 N respectively. Determine the angle between them when their resultant is $\sqrt{149}$ N. [3]
c) Distinguish between coefficient of friction and angle of friction? [2]
d) Distinguish between slip and creep in a belt drive? [3]
e) What does the second theorem of pappus indicate? [2]
f) Differentiate between Area moment of Inertia and Mass moment of Inertia. [3]
g) Define plane motion. [2]
h) Define Kinetic Energy and Potential Energy. [3]
i) Classify the types of motion. [2]
j) With a sketch, explain the difference between simple pendulum and compound pendulum? [3]

PART - B

(50 Marks)

2. A light string ABCDE whose extremity A is fixed, has weights W1 and W2 attached to it at B and C. It passes round a small smooth peg at D carrying a weight of 300 N at the free end E as shown in Figure 1. Find (a) Tension in the portion AB, BC and CD of the string and (b) Magnitude of W_1 and W_2. [10]

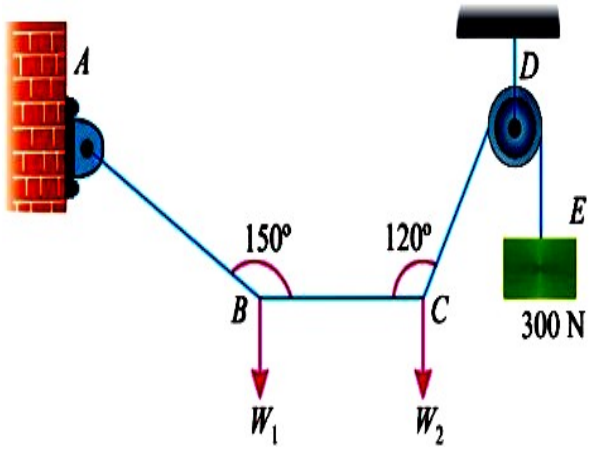

Figure 1

OR

3.a) Determine and locate the resultant and magnitude of the forces and couple acting on the beam as shown in figure 2.

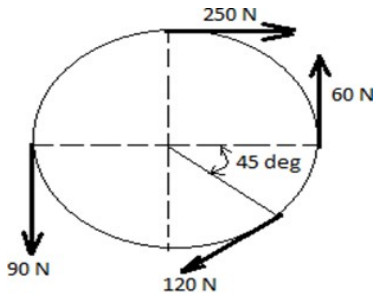

Figure 2

b) State and prove Lami's Theorem. [7+3]

4. Two blocks A and B of weights 1.5 kN and 2.5 kN respectively are in equilibrium position as shown in Figure 3. If the coefficient of friction between the two blocks as well as the block B and the floor is 0.3, find the force (P) required to move the block B. [10]

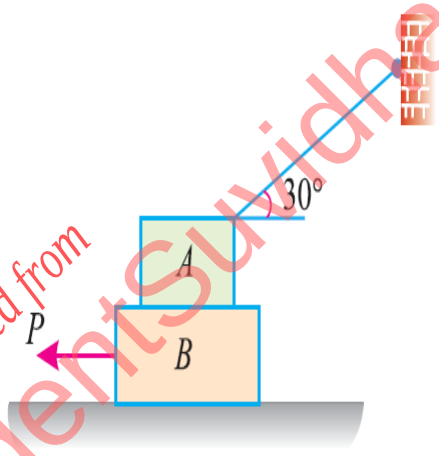

Figure 3

OR

5. An open belt running over two pulleys 1.5 m and 1.0 m diameters connects two parallel shafts 4.80 m apart. The initial tension in the belt when stationary is 3000N. If the smaller pulley is rotating at 600 rpm, and coefficient of friction between the belt and pulley is 0.3. Determine the power transmitted taking centrifugal tension into account. The mass of belt given as 0.6725kg/m length. [10]

6.a) Determine the polar mass moment of inertia of a circular ring of mean radius R and mass M.

b) What do you understand by axis of reference? [5+5]

OR

7.a) A semicircular area is removed from a trapezium as shown in figure 4. Determine the centroid of the remaining area.

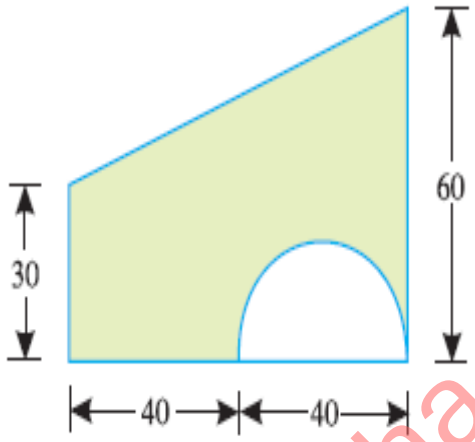

Figure 4

b) State and explain transfer formula for mass moment of inertia. [7+3]

8. A stone is dropped from the top of a tower, when it has fallen a distance of 10m, another stone is dropped from a point 38m below the top of the tower. If both the stones reach the ground at the same time, calculate:
a) the height of the tower and
b) the velocity of the stones when they reach the ground. [5+5]

OR

9. Two blocks of masses M_1 and M_2 are connected by a string as shown in Figure 5. Assuming the coefficient of friction between block M_1 and the horizontal surface to be μ. If the system is released from rest, find the acceleration and tension in the thread. Assume M_1=100kg and M_2=150kg and μ = 0.20. [10]

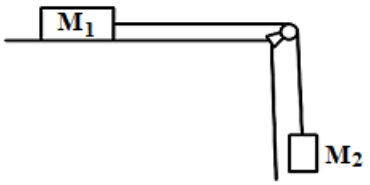

Figure 5

10.a) Under what circumstances the work energy method is used, and how the method of analysis differs from that of applying equation of dynamic equilibrium.

b) Explain the use of impulse momentum equation. [5+5]

OR

11.a) An elastic string of length 2L tightly stretched between two rigid supports as shown in Figure 6, carries a small ball of weight W at its mid-point. Show that for small displacements the ball will have a SHM. Compute the period?

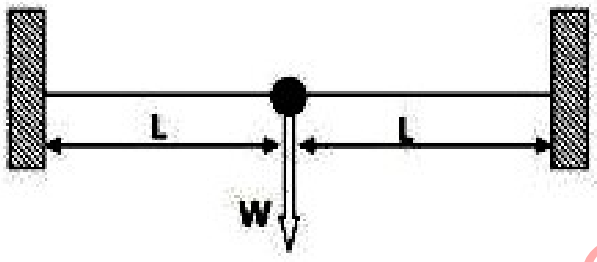

Figure 6

b) Derive the expression for the period of simple pendulum. [5+5]

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