

INDIAN MARITIME UNIVERSITY
(A Central University, Government of India)
End Semester Examinations- June-July 2019
Semester – I
B.Tech (Marine Engineering)
ENGINEERING MECHANICS-I (UG11T1105 / UG11T2105)

Date: 18-07-2019

Maximum Marks: 100

Time: 3 Hrs

Pass Marks: 50

PART A (3 X10=30)
Compulsory Questions

1.
 - a) Explain the conditions of the statically equilibrium systems. (3 Marks)
 - b) For the analysis of a truss explain the method of joints. (3 Marks)
 - c) Two forces are represented by $F_1^P = 12i^P + 20j^P - 10k^P$ and $F_2^P = 10i^P + 4j^P + 20k^P$, prove that the forces are perpendicular to each other. (3 Marks)
 - d) Explain coplanar and concurrent forces. (3 Marks)
 - e) What is moment of Inertia? (3 Marks)
 - f) Explain D'Alembert's principle. (3 Marks)
 - g) Explain Pappus-Guldinus Theorems. (3 Marks)
 - h) What are statically determinate and indeterminate Structures? (3 Marks)
 - i) What are normal and transverse components of acceleration? (3 marks)
 - j) Explain Principle of virtual work? (3 Marks)

PART B (5 X 14 = 70 Marks)
Answer Any Five of the following

2. The position of a particle moving along a straight line is given by the relation $X = 4t^3 - 12t^2 + 12t - 2$, where X is expressed as meters and t in seconds. Determine:
 - a) The time at which the velocity will be zero. (4MARKS)
 - b) The position and displacement at that time. (4 MARKS)
 - c) The time and velocity when acceleration is zero. (4 MARKS)
 - d) The displacement of the particle between 10 s and 20 s. (2 MARKS)
3. A body is resting on a horizontal plane and a pull of 100 N required at an angle of 30° to the horizontal, just to move it. It was also found that a push of 150 N required at an angle of 30° to the horizontal, just to move the body. Find the weight of the body and the coefficient of friction. (14 MARKS)
4. A train having 2000 KN weight moves with a speed of 90 Km per hour, is allowed to travel against a braking force of 10% of the weight. Find the distance it will cover before coming to rest on a level track. Assume friction of 5 % of the weight. Use D'Alembert's principle. (14 MARKS)
5. Determine the centroid of the plane area bounded by the curve $y = kx^2$ between the points (0, 0) and (a, b). (14 Marks)

6. a) Define parallel axis theorem. (4 Marks)
 b) Determine the moment of Inertia (I_{xx}) for the body as shown in the figure 2. (10 Marks)

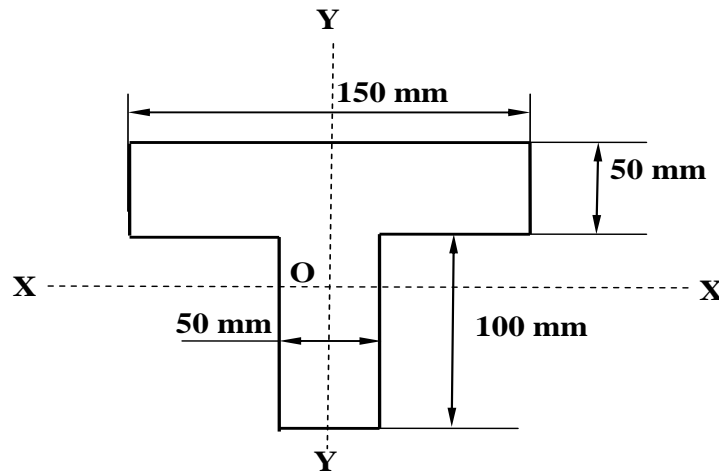


Fig. 2

7. A projectile is fired upwards at an angle of 30° with the horizontal with a velocity of 400 m/s. Calculate the following after 2.75 seconds:
- The horizontal and vertical distances
 - The horizontal and vertical velocities
 - What will be the horizontal range, maximum height and time period of the projectile?
 - Can the projectile get maximum range? Explain the condition for maximum range. (14 Marks)
8. What load will be lifted by an effort of 150 N, if the velocity ratio is 18 and efficiency of the machine is 70 %? Determine the law of the machine if it is observed that an effort of 250 N is required to lift a load of 2500 N and find the effort required to run the machine at a load of 4.5 KN. (14 Marks)
