INDIAN MARITIME UNIVERSITY

(A central University, Government of India)

May/June 2018-END SEMESTER EXAMINATION

B. Tech (Marine Engineering)

Semester: I

Engineering Mechanics I (UG11T3105)

Date: 12-07-2018 **Maximum Marks: 100**

Time: 3 hrs **Pass Marks : 50**

PART A (3 X10=30)
Compulsory Questions

1.

a) Explain the method of joints for the analysis of a truss. **(3 Marks)**

b) What are fixed vectors and sliding vectors? **(3 Marks)**

c) Explain Lami's theorem. **(3 Marks)**

d) What is moment of Inertia and radius of gyration? **(3 Marks)**

e) Draw the Free-Body Diagram of the body in figure 1 tied by the rope AO against the wall shown. **(3 Marks)**

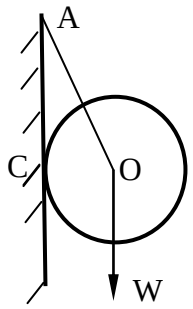

Fig.1

f) Explain D'Alembert's principle and Dynamic equilibrium. **(3 Marks)**

g) Explain Pappus-Guldinus theorems. **(3 Marks)**

h) What is Statically determinate and indeterminate Structures? **(3 Marks)**

i) Explain the terms Range, Time of flight, angle of projection and

trajectory of a projectile. **(3 marks)**

j) What is 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 $X= 5t^3-65t^2-50t +200$, where X is expressed as m and t in seconds. Determine:
a) The time at which the acceleration will be zero. **(4 MARKS)**
b) The position and displacement at that time**.** **(4 MARKS)**
c)The acceleration when velocity is zero.
(4 MARKS)
d)The displacement of the particle between 10 s and 20 s.
(2 MARKS)

3. Two blocks A and B of weights 150 N and 250 N respectively are connected by a string as shown in the figure 2. Determine the maximum inclination of the plane with the horizontal and force induced in the string when the system is about to move downward. Take coefficients of friction between the block A and plane and that between the block B and plane are 0.25 and 0.30 respectively. **(14 MARKS)**

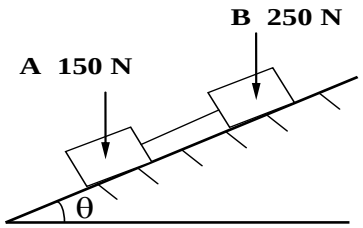

Fig. 2

4.a) Derive the Radial and Transverse components of acceleration in a plane curvilinear motion. **(8 Marks)**

b)The rotation of rod OA about O is defined by the relation $\theta = 2\ t^2$, where θ is expressed in radians and t in seconds. Collar B slides along the rod in such a way that distance from O is $r=60\ t^2-20\ t^3$, where r is expressed in mm and t in seconds. When t=1.0 determine the velocity of the collar.

(6 Marks)

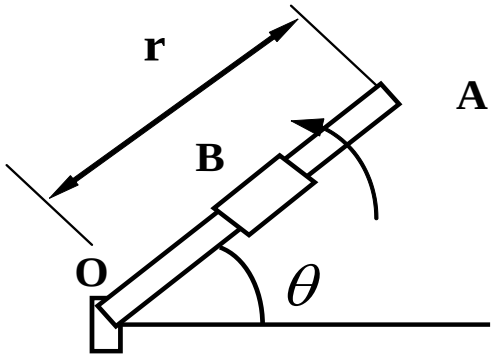

Fig. 3

5. Determine the centroid of the plane area bounded by the curve $y = kx^2$ between the points (0,0) and (a, b) and x=axis. **(14 Marks)**

6. Determine the moment of Inertia (I_{XX} and I_{YY}) for the body as shown in the figure 4. Here G is the C.G. of the body.
(14 Marks)

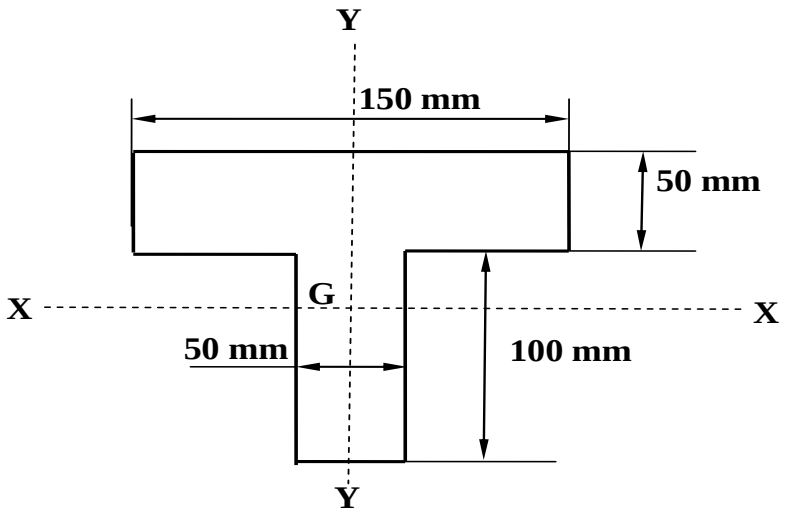

Fig. 4

7. A wall of 3 m height is 3 m in front of an enemy who is to be targeted. The gunman is 5 m away from the wall in the opposite direction of the target on the same horizontal

ground as shown in the figure. Find out the angle of projection and minimum projection velocity so that the bullet strikes the target. **(14 Marks)**

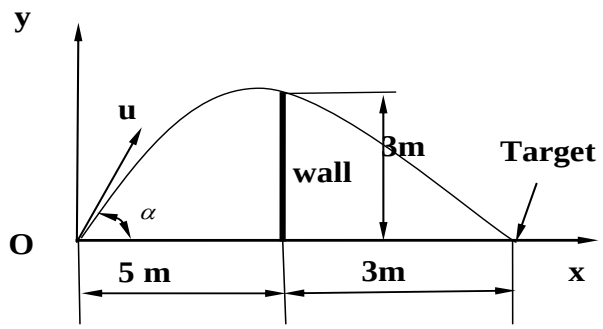

Fig. 5

8. What load will be lifted by an effort of 12 N, if the velocity ratio is 18 and efficiency of the machine is 60 %? If the machine has a constant frictional resiatance, determine the law of the machine and find the effort required to run the machine at i) No load and ii) A load of 900 N. **(14 Marks)**