INDIAN MARITIME UNIVERSITY

(A Central University, Government of India)

December 2016 End Semester Examinations
B.Tech. (Marine Engineering) First Semester

Engineering Mechanics - I (UG11T1105/ UG11T2105)

Date : 23.12.2016 | **Maximum Marks: 100**
Time: 3 Hrs | **Pass Marks : 50**

PART- A

Answer the compulsory question **(10x 3 = 30 Marks)**

1. a) State Varignon's theorem

b) State the theorems of Pappus and Guldinus to find out surface are and volume of a body

c) State the advantages of the principle of virtual work ?

d) Define principal axes and principal moments of Inertia?

e) A force of 15 kN forms an angle of 60^0, 45^0, 120^0 with x, y and z axes respectively. Find the components and express it as a vector.

f) State the difference between method of Joint and Method of Section with reference to a Truss ?

g) Given the vector $P= 4i - 2j+3k$; $Q = 2i+ 4j+ 5k$ and $R = 7i -j +x\ k$. determine the value of "x" for which the three vectors are co-planer

h) State the method of finding "Maximum range of a projectile if direction of projection and the angle between vertical and inclined plane are given?

i) Express the space curvilinear motion in cylindrical co-ordinates.

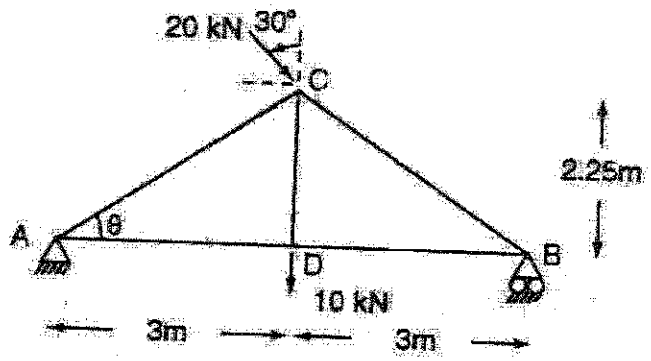
j) A particle moves in x-y plane with velocity $v_x= 12t$ and $v_y = 8t$. If it passes through the point $x= 8$, $y= 16$ at $t= 2$ sec, determine the equation of the path.

PART – B
(Answer any FIVE)

2. Determine the centroid of the region bounded by the curve $y = x^3$ and the lines $y=0$ and $x = 2$. [14 marks]

3. The position of a particle which moves along a straight line is given by $x = t^3 - 6t^2 - 15t + 40$; where x is measured in meters and t is in seconds. Determine (a) the time at which the velocity will be zero (b) the position and distance traveled by the particle at that time (c) the acceleration of the particle at that time, (d) the distance traveled by the particle from t = 4s to t = 6 s. . [4+4+4+2=14 marks]

4. Find the forces in all the members of the truss as shown in the figure below:



[14 marks]

5. Determine I_{xx}, I_{yy} and polar moment of inertia for the ellipse $x^2/a^2 + y^2/b^2 = 1$ about centroid [6 + 6+2=14 marks]

6. A particle moves along the curve $r = (t^3-4t)I + (t^2+4t)j + (8t^2 - 3t^3)$ where t denotes time. Show that the magnitudes of acceleration along the tangent at time t = 2 are 16 and $2\sqrt{73}$. [14 marks]

7. What load will be lifted by an effort of 120 N if the velocity ratio is 18 and the efficiency of the machine at this load is 60 % ? If the machine has a constant frictional resistance, determine the law of machine and find the effort required to run the machine at (i) no load and (ii) load of 900 N [14 marks]

8. A projectile is aimed to hit a target along a horizontal plane through the point of projection. It falls 10 m short when the angle of projection is 17^0 . When it overshoots the target by 25m when the angle of projection is 44^0. Find the angle of projection to the target.(14 Marks)

9. A pump lifts 100 m^3 of water to a height of 75 m and delivers it with a velocity of 7.5 m/ s. Determine the amount of energy spent. If the work is completed in 45 minutes . What is the input power of the pump having an efficiency of 75 % ? [14 marks]

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