Student Exam No. _____

Ganpat University

M.Tech SEM III (CAD/CAM) Mechanical Engineering

Regular Examination November / December 2016

3ME312 Dynamics of Mechanical System

Duration: 3hr **Marks: 60**

Instructions:

1. Assume suitable data if it is necessary.
2. Write your answer to the point and precisely.
3. Draw neat and clean sketch.

SECTION - 1

Q.1 **Attempt following questions**

(a) Derive the frenets' formula for curvilinear coordinates. **[06]**

(b) Write a short note on rectangular coordinate system. **[04]**

OR

Q.1 **Attempt following questions**

(a) Write a short note on curvilinear coordinate system and also on tangential and normal vector. **[06]**

(b) A particle moves along the surface $z = (x2 - y2)/L$ such that $x = L\cos(\beta\xi)$, $y = L\sin(\beta\xi)$, where β and L are constants and ξ is a parameter. Consider the case in which $\xi = t$. Derive expressions for the velocity and acceleration. **[04]**

Q.2 **Attempt following question**

Arm AB rotates clockwise at the constant rate of 30 rad/s as it pushes the slider along guide CD, which is described by $y = x^2/300$ (x and y are in millimeters) as shown in figure 2. Determine the velocity and acceleration of the slider when it is at the position $x = 250$ mm. **[10]**

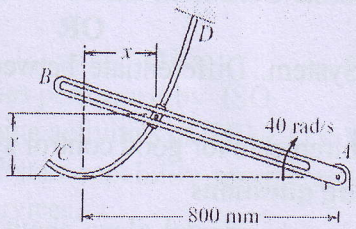

Figure 2

OR

Q.2 **Attempt following question**

Starting from the position shown in **figure 2 OR** , the box is rotated by 40° about face diagonal AB, clockwise as viewed from corner B toward corner A. Determine the coordinates of corner C relative to the fixed reference frame after this rotation. **[10]**

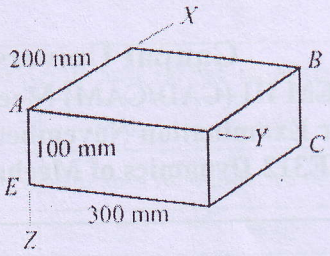

Figure 2 OR

Q.3 **Attempt following questions** **[10]**

(a) Derive velocity expression for spherical coordinate system with sketch.

(b) Write a short note on cylindrical coordinate system.

SECTION – II

Q.4 **Attempt following question**

The disc spins about shaft AB at the constant rate ω_1, where the vertical shaft, to which shaft AB is pinned, rotates freely. The masses are m_1 for the disk and m_2 for shaft AB. Derive the equation of motion. **[10]**

OR

Q.4 **Attempt following questions**

(a) A horizontal force F(t) is applied to the end of the compound pendulum whose pivot is given a specified horizontal displacement x(t). Generalized coordinates are the absolute angle of rotation θ_1 for the upper bar and the relative angle θ_2 for the lower arm. Determine the corresponding generalizes forces. **[08]**

(b) Evaluate Holonomic and Nonholonomic Constraint **[02]**

Q.5 (a) The crankshaft AB is given a virtual rotation $\delta\theta$ when it is at an arbitrary orientation θ. Determine the corresponding virtual displacement of the piston. **[08]**

(b) Evaluate Scleronomic Constraint and Rhenomic Constraint **[02]**

OR

Q.5 (a) Define Control System. Differentiate between open loop system and close loop system **[06]**

(b) What are the requirements for good control system? **[04]**

Q.6 **Attempt following questions**

(a) The table rotate in a horizontal plane about bearing A due to a torque $\tau(t)$. The mass of table is M and its radius of gyration about its centre is k. The slider, whose mass is m, moves within groove BC under the restraint of a pair of springs which are unstretched in the position. Derive the equation of motion for this system. **[08]**

(b) Evaluate Holonomic Constraint and Nonholonomic Constraint **[02]**

END OF PAPER