Seat No.: _____ *Enrolment No._____*

GUJARAT TECHNOLOGICAL UNIVERSITY

M. E. - SEMESTER – I • EXAMINATION – WINTER • 2014

Subject code: 2710907 **Date: 12-01-2015**

Subject Name: Advanced Engineering Dynamics

Time: 02:30 pm - 05:00 pm **Total Marks: 70**

Instructions:

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**

Q.1 **(a)** Derive the velocity and acceleration relations for a particle moving on a curved path using (r, θ) coordinate system. **07**

(b) The airplane climbs at a constant speed v and at a constant climb angle β. The airplane is being tracked by a radar station at point A on the ground. Determine the radial velocity and angular velocity as a function of the tracking angle θ. **07**

Q.2 **(a)** Explain the concept of joint kinematical analysis. **07**

(b) Discuss: Eulerian angles **07**

OR

(b) Collar B is pinned to arm AB as it slides over a circular guide bar. The guide bar translates to the left at a constant speed v, such that the distance from pivot A to the center C is vt. Derive the expression for the angular velocity of collar B. (see Fig. 1) **07**

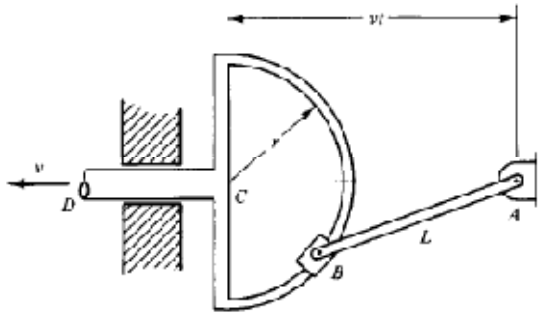


Fig. 1

Q.3 **(a)** Derive the momentum and energy principles for rigid bodies. **07**

(b) A homogeneous disk of mass m and radius R spins at rate ω_1 about its skewed axis, which rotates about the horizontal at rate ω_2. Derive an expression for the kinetic energy of the disk. (see Fig. 2) **07**

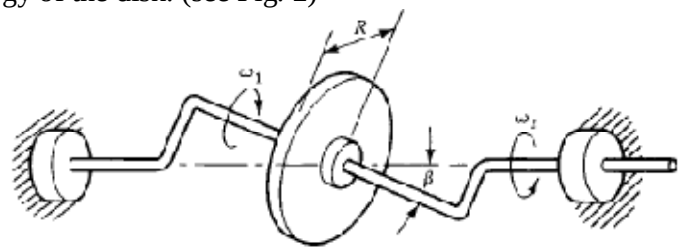


Fig. 2

OR

Q.3 **(a)** Derive Newton-Euler equation of motion for rigid bodies. **07**

(b) Determine the rate of change of diskôs centroidal angular momentum of Fig.2. Both ω_1 and ω_2 are constant. **07**

Q.4 **(a)** Derive the Lagrange form of Newton equation of motion. **07**

(b) Derive the equation of motion for the following system using Lagrange **07**

approach. (see Fig. 3)

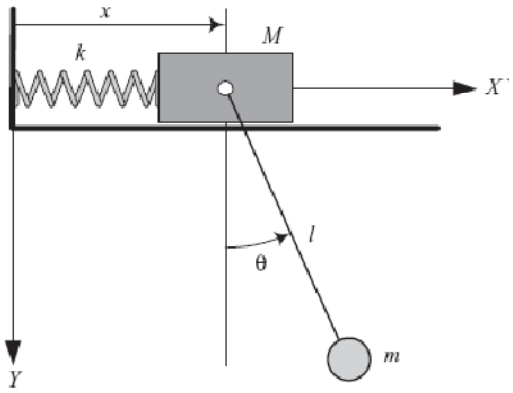
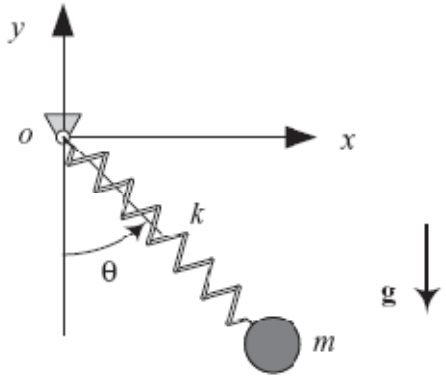


Fig. 3

OR

Q.4 **(a)** Discuss the Lagrange equation including potential force. **07**

(b) Derive the equation of motion for the following system using Lagrange approach. (see Fig. 4) **07**



Q.5 **(a)** Discuss the Hamilton principle **07**

(b) Prove that the virtual work done by the inertia forces is equal to the time rate of change of the work done by the momentum minus the virtual change in kinetic energy. **07**

OR

Q.5 **(a)** Discuss Lagrange equation with constraints. **07**

(b) Discuss the nonholonomic Hamilton principle with suitable example. **07**

****