

1058

B.E. (Mechanical), Second Semester
ME-201: Engineering Mechanics – II

Time allowed: 3 Hours

Max. Marks: 50

NOTE: Attempt five questions in all, including Question No. 1 which is compulsory and selecting two questions from each Part.

x-x-x

- Q1a) Write radial and transverse components of acceleration.
- b) What are the conditions for a body to be considered as a projectile
- c) What is instantaneous centre.
- d) What is an eccentric impact.
- e) Differentiate between damped and undamped vibrations. (10)

Part-A

- Q2a) A body is dropped from rest at height h . It covers a distance of $9h/25$ in the last second. Determine the height h . Take $g=10\text{m/s}^2$ (2)
- b) A particle moves along a curved path defined by $r=5\theta$ and $\theta=t^2/3$ where r is in metres and t is in seconds. Make calculations for the velocity and acceleration of the particle when $\theta=\pi/2$. (4)
- c) A projectile is fired with an initial velocity of 200 m/s to hit a target located 500 m above the level of gun point and at a horizontal distance of 3000 m . Neglecting the air resistance, determine the firing angle. (4)
- Q3a) Derive the equation for free flight trajectory of the satellite. Also draw the various trajectories of a satellite based on the value of eccentricity. (5)
- b) Packages having mass of 2 kg are delivered from a conveyor to a smooth circular ramp with the velocity of $V_0=1\text{ m/s}$ as shown in Fig 1. If the radius of the ramp is 0.5 m , determine the angle $\theta=\theta_{\max}$ at which the package begins to leave the surface using principle of work and energy. (5)

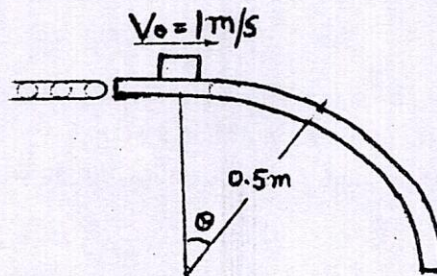


Fig 1

- Q4a) A body of 10 kg mass moving towards right with a speed of 8 m/s strikes with another body of 20 kg mass moving left with 25 m/s. Determine: A) Final velocities of two bodies B) Loss in kinetic energy due to impact C) Impulse acting on either body during impact. Take coefficient of restitution between bodies as 0.65. (5)
- b) Derive the relation for Coriolis component of acceleration. (5)

Part-B

- Q5a) The drum shown in Fig 2 has a mass of 60 kg and radius of gyration $k_o = 0.25$ m. A cord of negligible mass is wrapped around the periphery of the drum and attached to the block having a mass of 20 kg. If the block is released, determine the drum's angular acceleration. (5)

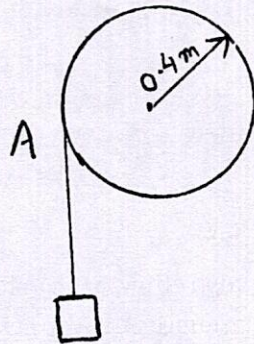
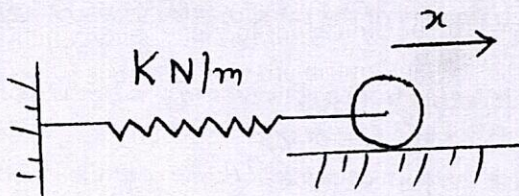


Fig 2

- b) State the principle of work and energy for a rigid body (3)
- c) What is the work of a couple subjected to a body undergoing general plane motion. (2)
- Q6a) Derive the relation for coefficient of restitution in eccentric impact. (5)
- b) Determine the natural frequency of the system as shown in Fig 3 (5)



Radius of cylinder is r
Mass of cylinder is m

Fig 3

- Q7a) What are forced vibrations. Write the differential equation of motion for viscous damped forced vibrations. Also determine the response of forced vibration system. (5)
- b) Write Eulers equations of motion of three dimensional kinetics of rigid body. (3)
- c) Define the term Product of inertia (2)