

Exam.Code:0906

Sub. Code: 6253

2014

B.E. (Mechanical Engineering)

Second Semester

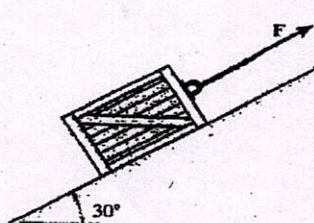
MEC-201: Rigid Body Dynamics

Time allowed: 3 Hours

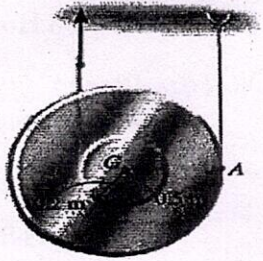
Max. Marks: 50

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

x-x-x

1	(a) Write radial and transverse components of acceleration. (b) What is coefficient of restitution? (c) State the principle of linear impulse and momentum. (d) Define areal velocity (e) Write the general equation of motion for viscous damped forced vibration	10
Section A		
2	(a) A boy is flying a kite that is 60m high with 75m of cord out. The kite moves horizontally from this position at a constant 6 km/h that is directly away from the boy. Ignoring the sag in the cord, determine how fast the cord is being let out at this instant and how fast this rate is increasing. (b) A projectile is fired with a velocity of 400 m/s at an elevation of 35°. Find the velocity and direction of the projectile moving after 29 second and 30 second of firing.	(5) (5)
3	(a) Drive an expression for free flight trajectory of the satellite. (b) The coefficient of kinetic friction between the 20-kg block and the inclined plane is $\mu_k = 0.2$ as shown in Fig-1. If the block is traveling up the inclined plane with a constant velocity $v = 5$ m/s, determine the power of force F.	(5) (5)
 <p style="text-align: center;">Fig-1</p>		
4	(a) An automobile weighing 1800kg is moving down a 5° inclined at a speed of 100 km/h when the brakes are applied, causing a constant total braking force (applied by the road on the tyres) of 7000N. Determine the time required for the automobile to come to a stop. (b) Derive the relation for coriolis component of acceleration.	(5) (5)

P.T.O.

Section B		
5	<p>(a) Determine the angular acceleration of the spool in Fig-2. The spool has a mass of 8 kg and a radius of gyration of $k_G = 0.35$ m. The cords of negligible mass are wrapped around its inner hub and outer rim.</p> <div style="text-align: center;">  <p>Fig-2</p> </div>	(5)
	<p>(b) Derive the relation for kinetic energy of rigid body having angular velocity ω and its mass centre having velocity V_G subjected to general plane motion. Also write the relation for kinetic energy of a rigid body during (a) Translation (b) Rotation.</p>	(5)
6.	<p>(a) Derive the relation for coefficient of restitution in eccentric impact.</p> <p>(b) If the 12-kg rod is subjected to a periodic force of $F = (30 \sin 6t)$ N, where t is in seconds, determine the steady-state vibration amplitude Θ_{\max} of the rod about the pin B. Assume Θ is small.</p>	(5) (5)
7	<p>(a) State Euler's theorem for three dimensional kinematics of rigid body.</p> <p>(b) What are critically damped and underdamped vibrations?</p>	(5) (5)