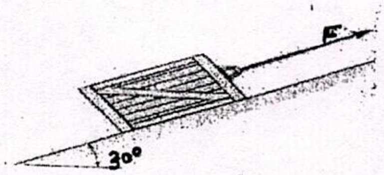
Exam.Code:0906
Sub. Code: 6827

2072
B.E. (Mechanical Engineering)
Second Semester
MEC-201: Rigid Body Dynamics

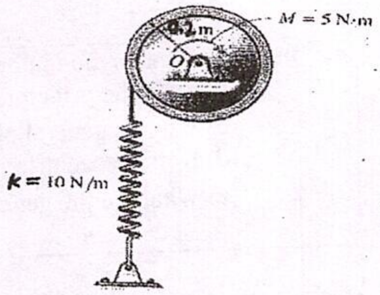
Time allowed: 3 Hours Max. Marks: 50

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

x-x-x

1	(a) What is the importance of inertial frame of reference in dynamics? (b) State the principle of linear Impulse and Momentum. (c) What is general plane motion? Give one example. (d) Define eccentric impact. (e) What are the general types of free vibrations?	(2x5)
	Section A	
2	**(a)** A motorist is traveling on a curved section of highway with a radius of 750 m at a speed of 90 km/h. The motorist suddenly applies the brakes, causing the automobile to slow down at a constant rate. If the speed has been reduced to 72km/h after 8 s, determine the acceleration of the automobile immediately after the brakes have been applied.	(5)
	(b) Two adjacent guns having the same muzzle velocity of 360 m/sec simultaneously fire shots at angles α_1 and α_2 respectively for the same target at a range of 4320 m. Calculate the time difference between the hits. Assume gravitational acceleration = 9.81m/sec^2.	(5)
3	(a) Prove that escape velocity (V_e) of a satellite is equal to $(2GM_e/r_0)^{1/2}$ where G is gravitational constant, M_e is the mass of earth and r_0 is the initial distance of satellite from center of the earth.	(5)
	(b) The coefficient of kinetic friction between the 20kg block and the inclined plane is μ_k=0.2 shown in the fig-1. If the block is traveling up the inclined plane with a constant velocity v=5m/s, determine the power of force F.  fig-1	(5)
4	(a) A 20-Mg railroad car moving at a speed of 0.5 m/s to the right collides with a 35- Mg car at rest. After the collision, the 35-Mg car moves to the right at a speed of 0.3 m/s. Determine the coefficient of restitution between the two cars.	(5)
	(b) Derive the relation for coriolis component of acceleration.	(5)

P.T.O.

	Section B	
5	**(a)** The 30-Kg disk shown in fig-2 is pin supported at its centre.Determine the angle through which it must rotate to attain an angular velocity of 2 rad/s starting from rest. It is acted upon by a constant couple moment M= 5N.m.The spring is originally unstretched and its cord wraps around the rim of the disk.  fig-2	(5)
	(b) Derive the relation for kinectic 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 kinectic energy of a rigid body during (i) Translation (ii) Rotation.	(5)
6.	**(a)** Derive the relation for coefficient of restitution in eccentric impact.	(5)
	(b) Drive the expression for magnification factor used in viscous damped forced vibration system.	(5)
7	(a) State Euler's theorem for three dimensional kinematics of rigid body. (b) What are critically damped and underdamped vibrations? (c) Explain the terms (i) Product of Inersia (ii) Inersia tensor.	(3) (3) (4)

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