Exam.Code:0906
Sub. Code: 6253

2054

B.E. (Mechanical Engineering)

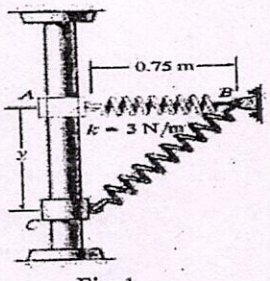
Second Semester

MEC-201: Rigid Body Dynamics

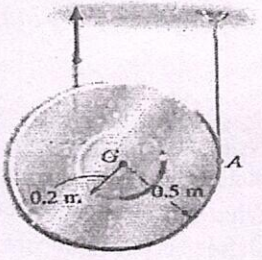
Time allowed: 3 Hours **Max. Marks: 50**

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

x-x-x

1	(a) Write radial and transverse components of acceleration. (b) State the principle of work and Energy. (c) What is general plane motion? Give one example. (d) Define eccentric impact. (e) What are the general types of free vibrations?	10
	Section A (Attempt any two questions)	
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) 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. (b) A smooth 2-kg collar, shown in Fig-1 fits loosely on the vertical shaft. If the spring is unstretched when the collar is in the position A, determine the speed at which the collar is moving when y = 1 m, if (i) it is released from rest at A, and (ii) it is released at A with an upward velocity V_A = 2 m/s.  Fig-1	(5) (5)
4	(a) A ball is thrown against a frictionless, vertical wall. Immediately before the ball strikes the wall, its velocity has a magnitude of v and forms an angle of 30° with the horizontal. Knowing that e=0.90, determine the magnitude and direction of the velocity of the ball as it rebounds from the wall. (b) A ball of mass 2 kg impinges on a ball of mass 4 kg which is moving in the same direction as the first. If the co-efficient of restitution is 3/4 and the first ball is reduced to rest after the impact, find the ratio between the velocities of the balls before the impact.	(5) (5)

P.T.O.

	Section B(Attempt any two questions)	
5	(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.  Fig-2	(5)
	(b) Derive the relation for coefficient of restitution in eccentric impact.	(5)
6.	(a) 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 kinetic energy of a rigid body during (i) Translation (ii) Rotation.	(5)
	(b) Drive the expression for criticaliy damped vibration system.	(5)
7	(a) State Euler's theorem for three dimensional kinematics of rigid body. (b) Explain the terms (i) Product of Inersia (ii) Inersia tensor.	(5) (5)

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