LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

SECOND SEMESTER – **APRIL 2023**

UPH 2501 – MECHANICS

Date: 29-04-2023 Dept. No. Max. : 100 Marks

Time: 01:00 PM - 04:00 PM

	SECTION A - K1 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
1.	**Answer the following**	
a)	Define Inertial frame.	
b)	What is a conservative force?	
c)	What is a rigid body?	
d)	State perpendicular axis theorem.	
e)	Define centre of mass.	
2.	**Fill in the blanks.**	
a)	_____, is the force exerted on a charged particle q moving with velocity v through an electric field E and magnetic field B.	
b)	The amount of work required to transport a body of unit mass from infinity to a given point is known as_____.	
c)	Motion repeated in equal intervals of time is called_____.	
d)	For a system with no external torque, the _____is constant.	
e)	Moving clocks appears to run _____	
	SECTION A - K2 (CO1)	
	Answer ALL the Questions	**(10 x 1 = 10)**
3.	**True or False**	
a)	Frictional forces are caused by intermolecular interactions between the bodies.	
b)	Gravity always acts as restoring force.	
c)	Damped harmonic oscillators are vibrating systems for which the amplitude of vibration increases with time.	
d)	Torque is a vector quantity.	
e)	The speed of light in vacuum, c, is the same for all inertial frames.	
4.	**Match the following**	
a)	Electric field intensity -	Joules per coulomb
b)	Angular momentum -	Time dilation
c)	Electric Potential -	SHM Motion
d)	Harmonic oscillator -	kg-m^2/sec
e)	Pion decay -	V/m
	SECTION B - K3 (CO2)	
	Answer any TWO of the following in 100 words	**(2 x 10 = 20)**
5.	Discuss the problem of Atwood's machine and obtain the expressions for acceleration of the masses and the tension in the string.	
6.	Applying the principles of conservation of total energy and conservation of angular momentum	

	estimate the distance of closest approach in the scattering of a proton by a heavy nucleus.
7.	Set up and solve the equation of motion of a damped harmonic oscillator and justify the statement 'the frequency of oscillation is independent of the amplitude' for low damping.
8.	Derive Lorentz transformation equations. What are their inverse transformations?
	SECTION C – K4 (CO3)
	Answer any TWO of the following in 100 words (2 x 10 = 20)
9.	Set up and solve the equation of motion of a body with an initial velocity v_0 moving on a horizontal frictional surface to find the time of travel and the distance it would move through before it comes to rest.
10.	What are conservative forces? Prove that the work done by a conservative force in displacing a particle from point A to point B is independent of the actual path travelled.
11.	Set up and solve the equation of motion of an LC circuit with inductance L and capacitance C and obtain the frequency of oscillations.
12.	Explain relativistic a) length contraction b) time dilation. (5+5)
	SECTION D – K5 (CO4)
	Answer any ONE of the following in 250 words (1 x 20 = 20)
13.	a) Explain in detail the effect of electric and magnetic forces on the motion of a charged particle. (10) b) Discuss Michelson-Morley experiment. What is the implication of its negative result? (10)
14.	a) State and prove the conditions to be satisfied for a system to execute simple harmonic motion. (5) b) Solve the simple pendulum problem and obtain the period of oscillation and frequency by (i) solving the equations of motion (ii) using the principle of conservation of energy (iii) using the torque method. (5+5+5)
	SECTION E – K6 (CO5)
	Answer any ONE of the following in 250 words (1 x 20 = 20)
15.	Analyze the motion of a charged particle of charge q and mass m in a uniform electric field. An electron initially at rest is accelerated through 1 cm by an electric field $3x10^4$ V/m. What is its terminal velocity? What would be the velocity of a proton under the same conditions?
16.	a) State and prove the parallel axes theorem of moment of inertia. (10) b) Estimate the average potential and kinetic energy of a harmonic oscillator. (10)

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