School of Basic and Applied Sciences

Mathematics

ETE - May 2023

Time : 3 Hours **Marks : 50**

Sem VI - BBS14T1010 - Classical Mechanics

Your answer should be specific to the question asked

Draw neat labeled diagrams wherever necessary

1.	Define kinetic energy remains constant when the moment of external forces about each principal axis is zero.	K2 CO1	(2)
2.	Define the Lagrange's function with usual notations.	K2 CO2	(2)
3.	Obtain the Hamiltonian function to the Lagrangian $L = a\dot{x}^2 + b\dot{y}^2 - kxy$.	K3 CO3	(2)
4.	Prove that [u, v + w] = [u, v] + [u, w], by applying Poisson Brackets.	K3 CO4	(2)
5.	What is the centrifugal force?	K4 CO5	(2)
6.	A body is rotating under no forces, about its center, at which principal moments are 2k, k and 3k respectively. If the initial angular velocity components about the principal axes are $\omega_1 = 0,\ \omega_2 = n\sqrt{3}, \omega_3 = n$, then find them at any time t.	K3 CO1	(5)
7.	Write down the Lagrange's equation of motion for a particle of mass m falling freely under gravity near the surface of earth.	K4 CO2	(5)
8.	Prove that the relavistic Hamiltonian is equal to the total energy of the system.	K6 CO6	(6)
9.	For a system with Lagrangian $L = \frac{1}{2}(\dot{q}_1^2 + \dot{q}_1\dot{q}_2 + \dot{q}_2^2) - V(q)$, show that the Hamiltonian is $H = \frac{2}{3}(p_1^2 - p_1p_2 + p_2^2) + V(q)$.	K4 CO3	(8)
10.	Show that the transformations : $2P = (p^2 + q^2)$, $Q = tan^{-1}(\frac{q}{p})$ are canonical. Find the generating function.	K4 CO4	(8)
11.	What are the electromagnetic analogy of inertial forces?	K5 CO5	(8)