22PHP205N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION MAY 2025
(Second Semester)

Branch- **PHYSICS**

CLASSICAL MECHANICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)
Answer **ALL** questions
ALL questions carry **EQUAL** marks (10 × 1 = 10)

Module No.	Question No.	Question	K Level	CO
1	1	If the generalised co-ordinate is an angle, then the dimension of the corresponding generalised force is a) momentum b) energy c) force d) torque	K1	CO1
	2	For a conservative system the potential energy does not depend upon a) Force b) generalised coordinate c) generalised velocity d) b and c	K2	
2	3	The Hamiltonian is defined as a) $\Sigma k\ pkqk' + L$ b) $\Sigma k\ pkqk' - L$ c) $\Sigma k\ pk'\ qk' + L$ d) $\Sigma k\ pk'qk' - L$	K1	CO2
	4	Hamilton's equations are a) $q' = -\partial H/\partial p,\ p' = \partial H/\partial q$ b) $q' = \partial H/\partial p,\ p' = -\partial H/\partial q$ c) $q = -\partial H/\partial p',\ p' = -\partial H/\partial q$ d) $q' = \partial H/\partial p,\ p = -\partial H/\partial q'$	K2	
3	5	The conservation of the angular momentum is the central force-field motion leads us to is a) Kepler's 1st law b) Kepler's 2nd law c) Kepler's 3rd law *d) None of these*	K1	CO3
	6	The value of eccentricity for an elliptic orbit is a) $\epsilon > 1$ b) $\epsilon = 1$ c) $\epsilon = 0$ d) $0 < \epsilon < 1$	K2	
4	7	If a rigid body is rotating with an angular velocity ω about an instantaneous axis through a fixed point in the body, the angular momentum vector **J** about the same point a) will be always in the direction of ω b) may have different directions to that of ω c) will be always perpendicular to ω d) None of the above	K1	CO4
	8	A heavy symmetrical top is rotating under the action of a gravitational angular momentum along the figure axis a) The torque is perpendicular to J3 b) The angular momentum J3 will change in magnitude c) The angular momentum J3 will remains constant in magnitude as well as in direction d) None of the above	K2	
5	9	Hamilton's canonical equations in terms of Poisson bracket are: a) $qk/dt = [qk, H],\ d\ pk/dt = [pk, H]$ b) $qk/dt = [pk, H],\ d\ pk/dt = [qk, H]$ c) $qk/dt = [H, qk],\ d\ pk/dt = [H, pk]$ d) $qk/dt = [H, pk],\ d\ pk/dt = [H, qk]$	K1	CO5
	10	The Hamiltonian is given by $H=(xp2+2ypq+zq2)/2$; the value of dq/dt is a) xp/2 b) xp+yq c)-(xp+yq) d) yq+zq	K2	

Cont...

SECTION - B (35 Marks)

Answer ALL questions
ALL questions carry EQUAL Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	Explain principle of virtual work and derive D'Alembert's principle.	K5	CO5
		(OR)		
	11.b.	Determine the equation of compound pendulum by Lagrangian method.		
2	12.a.	Deduce Hamilton's principle.	K3	CO2
		(OR)		
	12.b.	Use variational principle to deduce Lagrangian equation for non conservative system.		
3	13.a.	Analyze equation of motion under central force and first integral.	K4	CO2
		(OR)		
	13.b.	State and prove virial theorem.		
4	14.a.	Prove the rotation of earth by Foucault's pendulum.	K3	CO3
		(OR)		
	14.b.	Discuss about generalized coordinates for rigid body motion.		
5	15.a.	Determine Hamilton's equation of motion from variational principle.	K5	CO5
		(OR)		
	15.b.	Derive Hamilton Jacobi equations for Hamilton's principle.		

SECTION -C (30 Marks)

Answer ANY THREE questions
ALL questions carry EQUAL Marks (3 × 10 = 30)

Module No.	Question No.	Question	K Level	CO
1	16	Obtain Lagrange's equation from D'Alembert's principle.	K5	CO1
2	17	How Hamilton principle is used to determine i) Particle moving on the surface of earth ii) isotropic oscillators	K5	CO2
3	18	Evaluate the problem of scattering of a particle in a central force field.	K4	CO3
4	19	What is fast top? Discuss about it.	K4	CO4
5	20	Explain principle of least action.	K5	CO5

Z-Z-Z END