TOTAL PAGES : 2

22MAP313N

PSG COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS)

MSc DEGREE EXAMINATION DECEMBER 2025
(Third Semester)

Branch - **MATHEMATICS**

MECHANICS

Time: Three Hours Maximum: 75 Marks

SECTION-A (10 Marks)

Answer **ALL** questions

ALL questions carry **EQUAL** marks (10 × 1 = 10)

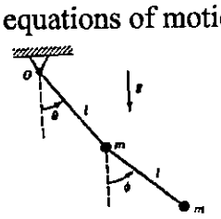
Module No.	Question No.	Question	K Level	CO
1	1	The space formed by a generalized coordinates is called ___ a) Cartesian space b) phase space c) configuration space d) orthogonal space	K1	CO1
	2	The principle of virtual work can be applied to elastic system by considering the virtual work of __ a) Internal forces only b) External forces only c) Internal as well as external forces d) constrain forces only	K2	CO1
2	3	____ is based on a direct application of newton's law of motion. a) variational dynamics b) kinetic energy c) potential energy d) analytical dynamics	K1	CO2
	4	A system having n degrees of freedom requires $2n$ integra[illegible] of the motion for a ____ a) complete solution b) holonomic system c) general solution d) conservative system	K2	CO2
3	5	The brachistochrone problem is one of the classical problems of the __ a) variational dynamics b) virtual displacement c) calculus of variations d) stationary value	K1	CO2
	6	The use of the multiplier rule leads to incorrect dynamical equations for the general case of ___ a) Hamilton Principle b) non holonomic constraints c) holonomic constraints d) holonomic equations	K2	CO2
4	7	The generating function, which is associated with the required ___ a) Legendre equation b) Canonical Integral c) Canonical transformation d) Legrange's function	K1	CO3
	8	____ is the modified Hamilton-Jacobi equation a) $H\left(q, \frac{\partial w}{\partial q}\right) = \alpha_n$ b) $H\left(\frac{\partial w}{\partial q}\right) = \alpha_n$ c) $H(q,p) = \alpha_n$ d) $H\left(\frac{\partial s}{\partial q_i}, \frac{\partial w}{\partial q}\right) = \alpha_n$	K2	CO3
5	9	A transformation from (q,p) to (Q,P) which preserves the canonical form of the equation of motion is ___ a) Hamilton b) generating function c) canonical transformation d) Hamitonian function	K1	CO4
	10	A general characteristic of the Lagrange bracket is that its value is invariant under a ___ a) dynamical variables b) canonical transformation c) Poisson bracket d) Jacobian determinants	K2	CO4

Cont...

SECTION - B (35 Marks)

Answer **ALL** questions

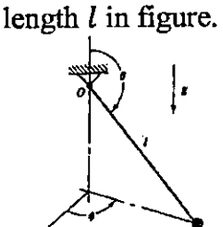
ALL questions carry **EQUAL** Marks (5 × 7 = 35)

Module No.	Question No.	Question	K Level	CO
1	11.a.	What are the holonomic constraints and nonholonomic constraints? Explain it.	K2	CO1
		(OR)		
	11.b.	Derive Lagrangian form of D'Alemberts's Principle.		
2	12.a.	A double pendulum consists of two particles suspended by massless rods, as shown in fig. Assuming that all motion takes place in a vertical plane, find the differential equations of motion. 	K3	CO2
		(OR)		
	12.b.	Derive Lagrange's equations with the Routhian function used in place of the Lagrangian function.		
3	13.a.	What is Hamilton's principle? How to get a generalized version of Hamilton's principle?	K3	CO2
		(OR)		
	13.b.	Use the Legendre transformation to obtain Lagrange's equations from Hamilton's equations.		
4	14.a.	State and prove Stackel's theorem.	K4	CO3
		(OR)		
	14.b.	What is the canonical integral associated with Hamilton's principle? Explain it.		
5	15.a.	State and prove Poisson's theorem.	K4	CO4
		(OR)		
	15.b.	Suppose the scleronomic extended point transformation $Q = tan\, q, \quad P = (p - mv_0)\, cos^2\, q$ where m and v_0 are constants. Show that the transformation is canonical and apply it to a specific mass-spring system.		

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	What is rotational kinetic energy? Give more details about it.	K4	CO1
2	17	Obtain the integrals of the motion for a spherical pendulum of length l in figure. 	K4	CO2
3	18	Derive Hamilton's equations.	K4	CO2
4	19	State and prove Jacobi's theorem.	K4	CO3
5	20	What are the comments on the Hamilton –Jacobi method? Explain it.	K4	CO4

Z-Z-Z END