



QP CODE: 25050527



25050527

Reg No :

Name :

MSc DEGREE (CSS) EXAMINATION DECEMBER 2025

First Semester

M Sc PHYSICS (MATERIAL SCIENCE)

Core Courses - PH020104 - CLASSICAL MECHANICS AND RELATIVITY

2019 Admission Onwards

F1E5AC0B

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

Answer any **eight** questions.

Weight **1** each.

1. State and explain D'Alembert's principle.
2. Define Lagrange's bracket and its properties.
3. Show that Hamilton's principal function is a generator of a canonical transformation to constant co-ordinates and momenta.
4. What is meant by sleeping top?
5. What are the effects of Coriolis force?
6. What is meant by normal modes of vibration?
7. Does $E = mc^2$ apply to particles that travel at the speed of light?
8. Write Lorentz force in covariant form.
9. What is charge current four vector?
10. What are different type of attractors?

(8×1=8 weightage)

Part B (Short Essay/Problems)

Answer any **six** questions.

Weight **2** each.

11. Write the Hamiltonian for a two dimensional harmonic oscillator and deduce its equations of motion.
12. A bead of mass m slides freely on a frictionless circular wire of radius a rotates in a horizontal plane about a point on the circular wire with a constant angular velocity ω . Find the reaction of the wire on the bead
13. Show that the transformation $Q = \ln\left(\frac{1}{q} \sin p\right)$ and $P = q \cot p$ is canonical.





14. Find the principal axes and the principal moments of inertia for a cube of mass M and sides a for an origin at one corner?
 15. Obtain Euler's equations of motion for a rotating rigid body.
 16. Consider a particle falling freely from a height h at latitude λ . Find its deflection from the vertical due to Coriolis force?
 17. A meson has a speed of $0.8c$ relative to the ground. Find how far the meson travels relative to ground, if its speed remains constant and the time of flight, relative to the system, in which it is at rest is 2×10^{-8} sec.
 18. Draw the phase curve of a simple pendulum and match it with the curve representing the potential
- (6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

Weight 5 each.

19. Briefly explain Hamilton- Jacobi Theory. Deduce the expression of Hamilton's Principal function and Hamilton's characteristic function and explain their physical significance.
20. What are action angle variables? Explain how they can be used to obtain the frequencies of periodic motion. Hence determine the frequency of linear harmonic oscillator.
21. Briefly explain the normal modes and normal frequencies of two coupled pendulum.
22. Explain the principle of equivalence.

(2×5=10 weightage)

