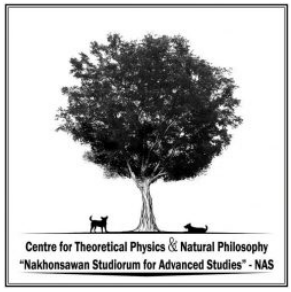

Mid-Semester Examination

Ph. D. Coursework, NAS-MUNA

Integrable System

(NWTP 601)

Instructor: Kumar Abhinav

Date: October 3rd, 2025

Time 10:00 - 12:00 hrs

Total time: 120 minutes | Semester 1/2025 | Total marks: 25

Instructions

I. Atatempt all the questions.

II. Use **ONLY** your class notebook(s).

III. Use either blue or black ink.

IV. Try to submit on time.

V. Individual marks are given in parentheses.

Questions:

1. a) Among Lagrangian and Hamiltonian approaches, which do you think is better and why? Mention one unique property of each approach. [2+1+1]

   b) Consider a system of two simple pendulum in a 3-dimensional space. What is the dimension of the corresponding phase space? Now replace the strings of each pendulum by a spring and also connect the masses with each other by another spring. What will be the new dimension of the corresponding phase space? [2+3]

   c) Explain in your own words why observable quantities have to be functionals for a continuous system. Demonstrate it for any one physical quantity of your choice. [2+2]

2. a) Show that the KdV equation is a continuity equation with proper charge and current. [3]

   b) List 4 different symmetries of the KdV equation. [1+1+1+1]

   c) Find out a Hamiltonian and the corresponding Poisson Bracket for the KdV system. [3+2]

Best wishes