Roll No..... Total No. of Units : 04

Total No. of Printed Pages : 03

Code No. : B01/201

First Semester Examination, January 2022

M.Sc. PHYSICS

Paper - II

CLASSICAL MECHANICS

Time : 3 Hrs. **Max. Marks : 80**

- Part A and B of each question in each unit consist of very short answer type questions which are to be answered in one or two sentences.
- Part C (Short answer type) of each question will be answered in 200-250 words.
- Part D (Long answer type) of each question should be answered within the word limit 400-450.

Unit - I

Q.1 A. Define the conservation law for linear momentum. **(2)**

Q.1 B. Define the virtual displacement. **(2)**

Q.1 C. What do you mean by Applied and constraint forces? **(4)**

OR

What are constraints? How they are classified?

Q.1 D. Define generalised coordinates and obtain the expression for generalised acceleration, generalised force and generalised potential. **(12)**

P.T.O.

OR

Prove the law of conservation of linear momentum, angular momentum and energy for a system of interacting particles.

Unit - II

Q.2 A. Define frame of reference. **(2)**

Q.2 B. What do you mean by mass-variation? **(2)**

Q.2 C. If the half-time of an elementary particle moving with speed 0.9c in the lab. Frame in $5x10^{-8}$s then find proper half-time. **(4)**

OR

Two electron moved towards each other, the speed of each being 0.9c in a Galilean frame of reference. What is their speed relative to each other?

Q.2 D. Derive Lorentz's transformation equations in the form of four vectors and write its applications. **(12)**

OR

Starting from the transformation laws for momentum and energy. Show that $\left(p^2 - E^2/c^2\right)$ is invariant quantity.

Unit - III

Q.3 A. Define the coriolis force. **(2)**

Q.3 B. Explain the radial motion. **(2)**

Q.3 C. How the two body problem can be converted into single body problem? **(4)**

OR

Explain the astronomical applications of the coriolis force.

Q.3 D. State and prove Kepler's first law of planetary motion. **(12)**

OR

Explain Rotating frames and integral force.

Unit - IV

Q.4 A. Define the Hamiltonian. **(2)**

Q.4 B. Explain phase space and motion of the system. **(2)**

Q.4 C. Discuss one dimensional harmonic oscillator problem, using Hamilton Jacobi method. **(4)**

OR

Explain the Poisson theorem.

Q.4 D. State and discuss the principle of least action. **(12)**

OR

Define the Poisson bracket of two dynamical variables. Show that for any three dynamical variables u, v, w the Jocobi identity.

$[u,(v,w)]+[v,(w,u)]+[w,(u,v)]=0$ is satisfied.

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