2020/TDC/ODD/SEM/
PHSH–301/094

TDC Odd Semester Exam., 2020
held in July, 2021

PHYSICS

(Honours)

(3rd Semester)

Course No. : PHSH–301

(Classical Mechanics and Theory of Relativity)

Full Marks : 35
Pass Marks : 12

Time : 2 hours

The figures in the margin indicate full marks for the questions

Answer **five** questions, taking **one** from each Unit

UNIT—I

1. *(a)* Define constraints of motion. What are the two types of constraints? Distinguish between them with example. 3

(b) For a compound pendulum, write down its Lagrangian and hence deduce its equation of motion. 4

2. What do you understand by generalized velocity and generalized momentum? From the principle of virtual work, obtain d'Alembert's principle. 3+4=7

UNIT—II

3. *(a)* What do you understand by central force? Explain with example. 2

(b) Find the Lagrangian of a particle moving under central force. 5

4. Write down the Kepler's laws of planetary motion and deduce the laws. 7

UNIT—III

5. What do you understand by phase space for a dynamical system? Deduce Hamilton's canonical equations from variational principle. 1+6=7

6. Find the Hamiltonian of a simple pendulum. Hence deduce Hamilton's canonical equations for the system. 2+5=7

UNIT—IV

7. *(a)* Explain the significance of the concept of ether in classical relativity. 2

(b) Show that in Galilean transformation velocity is not invariant but force is. 4

(c) What is the explanation for the negative result of the Michelson-Morley experiment? 1

8. *(a)* Discuss the limitations of Galilean transformation. 2

(b) Write down the Einstein's postulates for special theory of relativity. 3

(c) Apply the Galilean principle of relativity to prove that any two inertial frames are related by a Galilean transformation. 2

UNIT—V

9. *(a)* Using Lorentz transformation equation, find the speed at which a meter stick should move for its length to shrink to 0·5 m. 3

(b) Explain why the twin paradox is not a contradiction. 2

(c) What is relativity of simultaneity? 2

10. Write short notes on any *two* of the following : 3½×2=7

(a) Space-like and light-like intervals

(b) Minkowski diagram

(c) Energy-momentum four vectors

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