THIRD SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2023

(CBCSS - UG)

(Regular/Supplementary/Improvement)

CC19U PHY3 C03 / CC20U PHY3 C03 - MECHANICS, RELATIVITY, WAVES AND OSCILLATIONS

(Physics - Complementary Course)

(2019 Admission onwards)

Time : 2.00 Hours   Maximum : 60 Marks

Credit : 2

Part A (Short answer questions)

Answer *all* questions. Each question carries 2 marks.

1. What is a frame of reference?

2. Define non-inertial frame of reference. Give one example.

3. Show that apparent weight of a man in a lift is decreased if it is moving downwards with an acceleration.

4. Explain the conservation of linear momentum.

5. Provide a mathematical expression for the velocity of centre of mass of a particle.

6. State the postulates of special theory of relativity.

7. What is meant by length contraction?

8. Write down the energy momentum relation and explain the symbols.

9. Write down the equation of motion for Anharmonic oscillator.

10. What is meant by energy density of plane waves?

11. Define electromagnetic wave and its properties.

12. Write down the time dependent and time independent Schrodinger equation. Explain the symbols.

(Ceiling: 20 Marks)

Part B (Short essay questions - Paragraph)

Answer *all* questions. Each question carries 5 marks.

13. Show that the force $F = i(y^2 - x^2) + j2y + k4z$ is conservative.

14. Show that areal velocity of the particle moving under central force field remains constant.

15. Derive Lorentz velocity transformation equations.

16. Derive Simple harmonic motion. Derive differential equation of SHM and obtain the expression.

17. Define plane progressive harmonic wave. Obtain the equation of plane progressive harmonic wave and its periodicity.

18. Explain de Broglie hypothesis. What is the difference between De-Broglie's phase velocity and group velocity.

19. An eigen function of the operator $\frac{d^2}{dx^2}$ in wavefunction $\phi=e^{-2x}$. Find the corresponding eigen value.

(Ceiling: 30 Marks)

Part C (Essay questions)

Answer any *one* question. The question carries 10 marks.

20. (a) Explain the potential energy curve of a particle in one dimension. Obtain conditions of equilibrium of the particle.
    (b) Define potential well. Using Taylor's series expansion of potential energy derive an expression for potential energy of harmonic oscillator.

21. (a) What is Photo electric effect?
    (b) What are the laws of photo electric effect?
    (c) Derive Einstein's photo electric equation.

(1 × 10 = 10 Marks)

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