QP CODE: 22100037

22100037

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, JANUARY 2022

Fifth Semester

CORE COURSE - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

E827EB1C

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Define constraint motion.
2. Give the expression for generalized force for the virtual work done of the force F.
3. How do you describe a lagrangian function?
4. What is the Hamilton's canonical equation for the rate of change of generalized momentum?
5. Discuss the importance of Compton effect.
6. Explain the term matter wave.
7. What do you mean by eigenvalues and eigenstates of a system? Explain.
8. Explain the concept of continuity equation for probability current density function?
9. Explain the physical meaning of expectation values.
10. Write down the time dependent Schrödinger equation for a free particle in one dimension.
11. What is a wave function?
12. What are the admissibility conditions of wave function?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. State and explain Hamilton's principle, bring out the nature of variation involved.

14. What is the advantage of using Hamiltonian mechanics over Lagrangian mechanics?

15. Obtain the Hamiltonian H and the Hamilton’s equations of motion of a linear harmonic oscillator.

16. What are the failures of Rayleigh-Jeans formulation and how it leads to the formulation of Quantum mechanics?

17. Explain de Broglie's hypothesis. Why the wave nature of matter is not apparent in our daily observations?

18. Explain the stationary state with wave function.

19. Comapare the uncertainty in its Velocities of an electron and a proton confined in a 1.00 nm box.

20. Discuss the Ehrenfest theorem.

21. A proton in a one dimensional box has an energy of 400 KeV in its first excited state. Determine the width of the box.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Write short notes on
    a) virtual displacement and state how it is different from ordinary displacement.
    b)Virtual work done c) D'Alembert's Principle

23. What are the important conclusions on photoelectric effect? Give Einstein’s explanations of the different effects.

24. What is meant by matter waves? Give experimental evidence in support of the concept of these waves .

25. What is a stationary state? Derive steady state form of Schrodinger equation from time dependent form.

(2×10=20)

QP CODE: 22103396

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, NOVEMBER 2022

Fifth Semester

CORE COURSE - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

21FF60C5

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What is effect of constraints on the degrees of freedom?
2. How is virtual displacement different from ordinary displacement?
3. Write the lagrangian for a simple pendulum of length l and θ is the angle made by the string with the vertical axis.
4. What is Hamilton's principle?
5. Explain Planck's hypothesis of black body radiation.
6. What is De-Broglie hypothesis?
7. Explain the term matter wave.
8. What do you mean by eigenvalues and eigenstates of a system? Explain.
9. Write down any two postulates of quantum mechanics ?
10. Write down the time dependent schordinger equation.
11. Outline the probability interpretation of the wave function.
12. What do you meant by Stationary State?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. For a particle of mass m moving in space, using cylindrical co-ordinates (r,ϕ,z) as the generalized coordinates, calculate the generalized velocity and acceleration and hence the force components.
14. What is the advantage of using Hamiltonian mechanics over Lagrangian mechanics?
15. Write down the Hamiltonian for a linear harmonic oscillator and deduce its equations of motion.
16. Explain the characteristics of Wave function.
17. What is the physical signifance of wavefunction Ψ?
18. Find the expectation value of the position of a particle enclosed in a box of length L.
19. An electron has a speed of 600 m/s with an accurancy of 0.005%. Calculate the certainty with which we can locate the position of the electron h=6.6x10^{-34} Js and m=9.1x10^{-31}kg.
20. The lowest energy possible for a certain particle trapped in a certain box is 1.00eV .(a) What are the next two higher energies the particle can have? (b) If the particle is an electron , how wide is the box?
21. Write down the orthogonality condition foreigen functions.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Define the Hamiltonian and hence derive the Hamilton's canonical equations of motion.
23. Give the physical significance of Compton effect. Obtain an expression for the wavelength.
24. Describe Davisson and Germer experiments for the study of electron diffraction . What are the results of the experiments?
25. Discuss Ehrenfest theorem.

(2×10=20)

6

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QP CODE: 19102436

Reg No : .....

Name : .....

BSc DEGREE (CBCS) EXAMINATION, OCTOBER 2019

Fifth Semester

Core Course - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

B.Sc Physics Model I ,B.Sc Physics Model II Applied Electronics ,B.Sc Physics Model II Computer Applications,B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

9BE6B32C

Maximum Marks: 60 Time: 3 Hours

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What is the number of degrees of freedom for ten particles with ten constraints?
2. What is generalized coordinates?
3. How is virtual displacement different from ordinary displacement?
4. The Lagrangian equations of motion are _____ order differential equations.
5. Write down the Rayleigh-Jeans formula for black body radiation.
6. Write down the De- Broglie wave equation.
7. Explain the concept of probability current density?
8. What do you mean by the expectation value of an observable? Give an expression for it.
9. Uncertainty principle limits the equivalence of quantum and classical mechanics . Comment
10. What is Ehrenfest theorem?
11. Explain the requirements that are imposed on a physically acceptable wave function.
12. When do you say two functions are orthonormal?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Use Hamilton's principle to find the equation of motion of a simple pendulum.

14. Define the Hamiltonian and hence derive the Hamilton's canonical equations of motion.

15. Obtain the Hamiltonian H and the Hamilton's equations of motion of a simple pendulum.

16. During photoelectric emission from a material, the velocity of the emitted electrons is found to be 10^6 m/s when a light of wavelength 200 nm is used. Calculate the work function of the material.

17. An electron and a proton have the same velocity. Comapre the wavelengths and the phase and group velocities of their De Broglie waves.

18. Arrive stationary state or steady state form of Schrodinger equation.

19. What are the admissibility conditions for a wave function?

20. Obtain the equation of continuity in quantum mechanics.

21. Find the lowest energy of an electron confined to a one-dimensional box of length 3 A°.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Compare Newtonian, Lagrangian and Hamiltonian formulism and discuss the advantage and disadvantages of each.

23. Give the physical significance of Compton effect. Obtain an expression for the wavelength of a Compton scattered photon using particle conservation laws based on quantum theory.

24. Describe Davisson and Germer experiments for the study of electron diffraction . What are the results of the experiments?

25. Derive the Schrodinger's equation . What is the significance of the wave function?

(2×10=20)

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Reg No : .....

Name : .....

BSc DEGREE (CBCS) EXAMINATION, FEBRUARY 2021

Fifth Semester

Core Course - PH5CRT06 - CLASSICAL AND QUANTUM MECHANICS

B.Sc Physics Model I ,B.Sc Physics Model II Applied Electronics ,B.Sc Physics Model II Computer Applications,B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

51C18AFF

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Name the constraints that are independent of time.
2. Write down the mathematical expression for Hamilton's principle.
3. Write down the basic equation from which the Hamilton's canonical equations of motion can be obtained.
4. What is the Hamiltonian for a linear harmonic oscillator ?
5. What is Compton effect ?
6. What was the purpose of Davisson-Germer experiment ?
7. What is group velocity? Write down an expression for group velocity.
8. If operators A and B are Hermitian , show that i[A,B] is Hermitian.
9. Explain the physical meaning of expectation values.
10. What is the physical significance of wave function?
11. What do you meant by Stationary State?
12. What is meant by normalising a wave function?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. For a particle of mass m moving in space, using spherical polar (r,θ,ϕ) as the generalized coordinates, express the virtual displacements δx, δy and δz in terms of r,θ and ϕ.
14. Obtain the equation of motion of a planetary motion in Lagrangian formulation.
15. What is the advantage of using Hamiltonian mechanics over Newtonian?
16. Calculate the number of photons emitted per second by a 40 W source of monochromatic light of wavelength 600 nm.
17. Why the electrons shows wave nature but the moon does not?
18. Find the eigen function of operator (x+d/dx) with eigen value 2.
19. A proton is confined to a nucleus of radius 5 fm. Estimate the minimum uncertainty in its momentum.
20. Discuss the Ehrenfest theorem.
21. A particle constrained to move along x-axis in the domain 0≤X≤L has a wave function Ψ(x)= Sin (nπx/L), where n is an integer.Normalize the wave function and evaluate the expectation value of its momentum.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Define generalized coordinates. How are they different from the ordinary coordinates. Discuss the transformation of Cartesian coordinates to polar coordinates and spherical polar coordinates and vice versa.
23. Derive Planck's radiation law. Discuss its high and low frequency limits.
24. What do you meant by normalization?
25. Develop the time dependent Schrodinger equation.

(2×10=20)