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RN-003-001501 Seat No. _____

B. Sc. (Sem. V) (CBCS) Examination

February - 2019

Physics : Paper - 501

(Mathematical Phy., Classical Mechanics & Quantum Mechanics)

(Old Course)

Faculty Code : 003

Subject Code : 001501

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

Instructions : (1) All questions are compulsory.
(2) Figures on right side indicate marks.
(3) Symbols have their usual meaning

1 Answer all questions : (Each 1 marks) **20**

(1) What are constraints?

(2) If $a_0 = 1/2, a_n = (-1)^n \pi$ and $b_n = 0$ then what will be the Fourier series ?

(3) In what interval the function $x/1-x$ does not satisfy the Di-Richlet's condition?

(4) What is meant by rheonomous constraints?

(5) A system of N particle having K eqn of contains has _____ degree of freedom.

(6) The generalized co-ordinates in case of simple pendulum is _____

(7) Langrange's formula is need not be restricted to the mechanical system only _____ statement is True or false?

(8) Write Hermitian adjoint of

$(1+i)AB + (2+i)BC + (3+i)CA.$

(9) A phase space is _____ dimension space.

(10) Find the Hermite adjoint of operator $\hbar(d/dx)$

(11) What is meant by V_0/Δ in square well potential ?

(12) Write an expectation value of potential energy.

(13) $\left[x, p_x\right] = \left[y, p_y\right] = \left[z, p_z\right] =$ _____

(14) The probability of finding the particle in differential region dx is can be represented as _____

(15) $\left(AB\right)^{+}$ = _____ if A & B are operators, then find the value of $\left(AB\right)^{+}$.

(16) Write the general expression for the free particle energy eigen function in 1 – dimension.

(17) Write an energy operator and momentum operator used in quantum mechanics.

(18) Simplify Expressions $\left[X, Px^2\right]$ and $\left[X^2, Px\right]$ Or its value only.

(19) Eigen value of self adjoint operator is _____ (ans. Or fill in the blanks)

(20) What is the SI unit of probability current density in one dimension? & In three dimension?

2 (A) Answer the following questions : (Any **Three**) **6**

(1) Write about conservation of angular momentum?

(2) Write about conservation of linear momentum?

(3) What is meant by holonomical constraints?.

(4) What is generalized co-ordinates?

(5) State and explain Hamiltonian principle?

(6) Write advantages of Langrangian formulation with suitable example.

(B) Answer the following questions : (Any **Three**) **9**

(1) Explain non holonomic constraints.

(2) Explain cyclic co-ordinates?

(3) Define the Hamiltonian.

(4) What is phase space?

(5) Explain Langrangian undetermined multipliers.

(6) Describe configuration space.

(C) Answer the following questions : (Any **Two**) **10**

(1) Derive an eqn for simple pendulum with moving support, by Hamiltonian formulations.

(2) Apply the Langrangian method of undetermined multipliers for cylinder rolling on inclined plane.

(3) Write a Hamiltonian principle from Newton's equation.

(4) Derive D'Alembert's principle

(5) Derive the eqn for Atwood's machine.

3 (A) Answer the following questions : (Any **Three**) **6**

(1) Define eigen value.

(2) Define Dirac delta function,' and its property.

(3) Write about expectation value and expectation value of energy.

(4) Define stationary state.

(5) Write one admissibility condition for wave function.

(6) Define adjoint operator.

(B) Answer the following questions : (Any **Three**) **9**

(1) What is eigen function? Explain it.

(2) Briefly discuss eigen value and eigen functions of self adjoint operator.

(3) What is meant by normalization? Why we need for normalization of wave function.

(4) Write a short note on conservation of probability.

(5) Derive time independent Schrodinger eqn.

(6) What is box normalization and non-normalizable wave function.

(C) Answer the following questions : (Any **Two**) **10**

(1) Derive a Schrodinger eqn for free particle in one dimension.

(2) Write about Ehrenfest theorem.

(3) Derive an eqn for particle in square well potential, bound states in a square well $(E < 0)$

(4) Give a complete mathematical analysis of Schrodinger eqn for the probability interpretation for an N-particle system.

(5) Describe in details of fundamental postulates of wave mechanics, with necessary example (at least two postulates).
