MCP-003-001501

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Seat No. ______

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

May / June - 2018

Physics : Paper - 501

Faculty Code : 003
Subject Code : 001501

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

Instructions : (1) Attempt all the questions.
(2) Figures on right side indicate marks.

1 All short questions are compulsory : **20**

(1) If the system is made up of N particles and particles moving independently of each other, the number of degree of freedom ________

(2) If the constrains relation is independent of time, the constrains is known as ________

(3) The equation of generalized force $Q_j =$ ________

(4) If 3C charge moving with velocity of $2 \times 10^5 \hat{j}\ m/s$ in magnetic field of $10^{-5} \hat{k}\, T$ and electric field of $10\ \hat{i}\ NC^{-1}$. Find the Lorentz force on particle.

(5) Phase space is ________ dimensional space.

(6) The mathematical form of Hamilton's principle is ________.

(7) In LCR parallel circuit capacitor corresponds to ________

(8) Lagrangian function L = ________

(9) The wave function represents ________ waves.

(10) The value of $\frac{\partial}{\partial t}\int |\psi|^2\, d^3x =$ ________

(11) The operator of momentum is given by ________

(12) In the equation of $\left(\alpha^2+\beta^2\right)a^2 = V_0/\Delta$, the value of Δ is _________.

(13) If $\phi = e^{i\theta}$, where $0 < \theta < 2\pi$. Obtain the normalized function.

(14) $\left[x, P_x^n\right] =$ ________

(15) $\left[P_x, x\right] =$ _______

(16) If $i = j$, Kronecker delta function $\delta_{ij} =$ ________.

(17) $(CA)^\dagger$ = __________

(18) The value of coefficient a_n is _________ in Fourier series for interval $(-\pi, \pi)$.

(19) The value of series $1+\frac{1}{3^2}+\frac{1}{5^2}+$.......... using Fourier method is _________.

(20) For even function, the value of b_n is _________ in Fourier series for interval $(-\pi, \pi)$.

2 (a) Give any three answer in brief : **6**

(1) Find the value of $\sum \frac{1}{n^2}$ using Fourier series.

(2) Obtain the wave form of square wave using Fourier series.

(3) What are called constraints? Give its type.

(4) Obtain the Newton's equation from Lagrange's equation.

(5) Explain D'Alembert's principle.

(6) Obtain Lagrange's equation from Hamilton's principle.

(b) Give any three answer : **9**

(1) Obtain the cosine series and sine series.

(2) Develop $f(x)$ in Fourier series in the interval $(-2, 2)$ if $f(x) = 0$ for $-2 < x < 0$ and $f(x) = 1$ for $0 < x < 2$.

(3) Obtain the equation of compound pendulum from Lagrange's equation.

(4) Obtain the Hamilton's equation from Lagrangian function and derive H = E

(5) Explain configuration space.

(6) Explain generalized coordinates.

(c) Give any two answer in detail : **10**

(1) Define the Fourier series. Evaluate its coefficient.

(2) Obtain the Lagrange's equation of motion.

(3) Explain Rayleigh's dissipation function.

(4) Obtain the Hamilton's principle from Newton's equation.

(5) Explain the Lagrange's undetermined multiplier with its application.

3 (a) Give any three answer in brief : **6**

(1) Obtain the Schrodinger equation in force field.

(2) Explain physical interpretation of wave function (ψ).

(3) If $\phi = ae^{i(kx-wt)}$, where $-1 < x < 1$, obtain the normalized wave function.

(4) Discuss cyclic coordinates.

(5) Show that : $\left[x, P_y\right] = 0$

(6) Show that : $(A+B)^{\dagger} = A^{\dagger} + B^{\dagger}$

(b) Give any three answer. **9**

(1) Explain Box normalization.

(2) Derive the time independent Schrodinger equations.

(3) Discuss the admissibility conditions of the wave function.

(4) Prove that momentum operator is self adjoint operator.

(5) Show that : $\left[L_x, L_Y\right] = i\hbar L_z$

(6) Show that: Eigen value of Self Adjoint operator is real.

(c) Give any two answer in detail : **10**

(1) Obtain the Schrodinger equation for a free particle in one dimension.

(2) Derive that probability is conserved.

(3) Prove that : $\langle F_x \rangle = \frac{d\langle P_x \rangle}{dt}$

(4) If a particle in a square well potential, obtain its solution when $(E < 0)$.

(5) Explain the postulate for representation of state in wave mechanics.