



MAJ-003-001501

Seat No. _____

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

October / November – 2016

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 questions are compulsory : **20**

- (1) The value of coefficient a_n is _____ for Fourier series in interval $(-\pi, \pi)$.
- (2) For even function, $f(-x) =$ _____.
- (3) What is the value of $\sum_{n=1}^{\infty} \frac{1}{n^2}$?
- (4) If $f(x) = x + x^2$, find the average value at point $-\pi$ and π .
- (5) If the particle moves in plane, the particle have _____ degree of freedom.
- (6) The example of bead on a rotating wire loop is _____ constrains.
- (7) What is the equation of generalized velocity?
- (8) The Lorentz force equation is _____.
- (9) For conservative system, force is negative gradient of _____.
- (10) In configuration space a state of a system having _____ co-ordinates.
- (11) In LCR series circuit inductor corresponds to _____.
- (12) Hamilton's equation of motion is $\frac{\partial H}{\partial P_j} =$ _____.

- (13) According to De-Broglie hypothesis $P = \underline{\hspace{2cm}}$.
- (14) The max born interpretation for wave function is based on concept of $\underline{\hspace{2cm}}$.
- (15) In quantum mechanics, Hamitonian operator is function of H ($\underline{\hspace{2cm}}$).
- (16) Free particle possesses only $\underline{\hspace{2cm}}$ energy.
- (17) In quantum mechanics, momentum operator $P = \underline{\hspace{2cm}}$.
- (18) $[z, P_z] = \underline{\hspace{2cm}}$
- (19) $(AB)^\dagger = \underline{\hspace{2cm}}$
- (20) In three dimension, Dirac delta function is $\delta(\vec{r} - \vec{r}') = \underline{\hspace{2cm}}$.

- 2** (a) Give any three answer in brief : **6**
- (1) Draw the graph for even and odd function in interval of $(-\pi, \pi)$.
 - (2) Obtain the wave form equation of full wave rectifier using Fourier series.
 - (3) What is called holonomic and nonholonomic constraints ?
 - (4) Explain D'Alembert's principle.
 - (5) Discuss cyclic coordinates.
 - (6) Explain Hamilton's principle.
- (b) Give any **three** answer : **9**
- (1) Obtain the cosine series and sine series.
 - (2) Obtain the equation of generalized force.
 - (3) Obtain the equation of simple pendulum from Lagrange's equation.
 - (4) Explain Rayleigh's dissipation function.
 - (5) Obtain the Newton's equation from Lagrange's equation.
 - (6) Explain the Lagrange's undetermined multiplier.

(c) Give any two answer in detail : 10

(1) Define the Fourier series. Evaluate its co-efficient.

(2) Find the Sine and Cosine series of function $f(x)$

in interval of $(-\pi, \pi)$, where,

$$f(x) = 0 \quad \text{when } -\pi < x < 0$$

$$f(x) = \frac{\pi x}{4} \quad \text{when } 0 < x < \pi \text{ and deduce}$$

$$\frac{\pi^2}{8} = 1 + \frac{1}{3^2} + \frac{1}{5^2} + \dots$$

(3) Obtain the equation of velocity dependent potential in electromagnetic field.

(4) Obtain the equation for Atwood's machine from Lagrange's equation.

(5) Obtain the Hamilton's equation of motion.

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

(1) Derive Schrodinger equations in force field.

(2) Explain : Box normalization.

(3) If $\phi = ae^{-i\theta}$ where $0 < \theta < 2\pi$, obtain the normalized function.

(4) Explain Adjoint operator and self-adjoint operator.

(5) Show that : $\left[x, P_x^n \right] = n i \hbar P_x^{n-1}$

(6) Prove that momentum operator is self adjoint.

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

(1) Derive the time independent Schrodinger equations.

(2) Prove that : $\langle P_x \rangle = m \frac{d \langle x \rangle}{dt}$

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

(4) Discuss the postulate for representation of state for wave mechanics.

(5) Show that : $[L_x, L_y] = iL_z$

(6) Show that :

(i) $(A+B)^\dagger = A^\dagger + B^\dagger$ and

(ii) $(CA)^\dagger = C^* A^\dagger$

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

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

(2) Explain : Conservation of probability.

(3) Obtain the solution of a particle in a square well potential ($E < 0$).

(4) Show that : Expectation value and Eigen values of Self-adjoint operator are real.

(5) Explain : Dirac delta function.

