Shree H.N.Shukla group of colleges

PHYSICS

T.Y.B.Sc. (Sem. V) (CBCS)

Preliminary Examination

PAPER- 501

MATHEMATICAL PHYSICS, CLASSICAL & QUANTOM MECHANICS

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

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

1 (A) Answer the following questions : **4**

(1) The value of coefficient a_n is _____ for Fourier series in interval $(-l, l)$.

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

(3) Sine series also known as _____ series.

(4) For odd function $f(-x) =$ _____

(B) Give any **one** answer in brief from following questions : **2**

(1) Obtain the complex form of Fourier series.

(2) Explain the advantages of Fourier series.

(C) Give any **one** answer in detail from following questions : **3**

(1) Explain the properties of Dirac Delta function.

(2) Obtain the Fourier cosine series.

(D) Write a note on any **one** in detail from following questions : **5**

(1) Obtain the Fourier series for full wave rectifier function.

(2) Explain in detail Fourier integral.

2 (A) Answer the following questions : **4**

(1) When a particles moves three dimension specs, it has _____ degree of freedom.

(2) What is the generalized coordinate of a simple pendulum?

(3) Write the equation of generalized force.

(4) Give the expression of Hamilton's principle.

(B) Give any **one** answer in brief from following questions : **2**

(1) Explain configuration space.

(2) Explain generalized displacement and generalized velocity.

(C) Give any **one** answer in detail from following questions : **3**

(1) Obtain Newton's second law of motion from Hamilton's principle.

(2) Explain Rayleigh's dissipation function.

(D) Write a note on any **one** in detail from following questions : **5**

(1) What are called constraint motion? Explain the classification of constraints.

(2) Obtain the Lagrange's equation of motion from D'Alembrt's principle for conservative system.

3 (A) Answer the following questions : **4**

(1) Write the equation of motion of compound pendulum.

(2) Hamiltonian is function of _____ , _____ and _____.

(3) Lagrangian $L = L$ (_____, _____, _____)

(4) Define the phase space of n coordinate system.

(B) Give any **one** answer in brief from following questions : **2**

(1) What is called cyclic coordinate? Explain generalized momentum from it.

(2) Discuss physical signification of Hamiltonian.

(C) Give any **one** answer in detail from following questions : **3**

(1) Obtain the Hamilton's canonical equation of motion.

(2) Explain superiority of Lagrangian approach over Newtonian approach.

(D) Write a note on any **one** in detail from following questions : **5**

(1) Obtain the equation of simple pendulum from Lagrange's multiplier method.

(2) Explain conservation of linear momentum.

4 (A) Answer the following questions : **4**

(1) The momentum operator in three dimension is given by _____

(2) $[x, P_x] =$ _____

(3) The ejected electron in compton effect is known as _____ electron.

(4) The term $\int \psi^* x \psi$ is known as _____ values of position.

(5) What is the orthogonality condition?

(B) Give any **one** answer in brief from following questions : **2**

(1) Drive the value of $[P_x, P_y]$

(2) Normalize the function $\psi = A\, e^{ikx}$ over the region $-a < x < a$.

(C) Give any **one** answer in detail from following questions : **3**

(1) Explain the experimental study of photoelectric effect.

(2) Discuss the uncertainty principle.

(D) Write a note on any **one** in detail from following questions : **5**

(1) Explain kinematics of Compton effect and obtain the equation of Compton shift.

(2) Derive the Schrodinger equation for free particle in one dimension.

5 (A) Answer the following questions : **4**

(1) $L_z = -i\hbar$ (_____)

(2) What is the ground state energy of harmonic oscillator?

(3) If A is unit operator then, $\alpha|A\rangle =$ _____

(4) What is the Hamiltonian for a linear harmonic oscillator?

(B) Give any **one** answer in brief from following questions : **2**

(1) Explain linear operator.

(2) Obtain the wave function of harmonic oscillator from bra and ket notation.

(C) Give any **one** answer in detail from following questions : **3**

(1) Explain the coherent state.

(2) Explain ket and bra vector.

(D) Write a note on any **one** in detail from following questions : **5**

(1) Obtain the simplified form for the oscillator from Schrodinger equation.

(2) Obtain the Hermite's differential equation.

_____