



Seat No. _____

HAL-003-0493006

**B. Sc. / M. Sc. (Applied Physics)
(Sem.-III) (CBCS) Examination**

June - 2023

**Modern Physics-II : Paper-XII
(New Course)**

Faculty Code : 003

Subject Code : 0493006

Time : $2\frac{1}{2}$ Hours / Total Marks : 70

Instructions: (1) All questions are compulsory.
(2) Numbers in the right indicate marks.

- 1 (A) Write Answers: **4**
- (1) Define microscopic system.
 - (2) Define distribution function.
 - (3) What is significance of M-B distributive law.
 - (4) Define phase point.
- (B) Write Answer of any **one**: **2**
- (1) Give the example of macroscopic system.
 - (2) Write a note on classical and quantum statistics.
- (C) Write Answer of any **one**: **3**
- (1) Compare the M-B, B-E and F-D statistics.
 - (2) Write a note on three statistical distribution function with necessary diagram.
- (D) Write Answer of any **one**: **5**
- (1) Derive an expression for probability distribution for a Bose-Einstein system of particles.
 - (2) State and explain the law of equipartition of Energy.

- 2 (A) Write Answers: 4
- (1) Define spontaneous emission.
 - (2) What is population inversion?
 - (3) Write the full form of LASER.
 - (4) Define radiative transition.
- (B) Write Answer of any **one**: 2
- (1) Write the principle of LASER.
 - (2) Define inelastic atom-atom collision pumping method.
- (C) Write Answer of any **one**: 3
- (1) Describe different pumping method used in LASER.
 - (2) Derive relation between Einstein's coefficients.
- (D) Write Answer of any **one**: 5
- (1) Describe the construction and working of RUBY LASER.
 - (2) Describe the construction and working of He-Ne LASER.
- 3 (A) Write Answers: 4
- (1) What is π -mesons?
 - (2) Define isospin.
 - (3) What is conservation law?
 - (4) How do we classify the elementary particles?
- (B) Write Answer of any **one**: 2
- (1) Write a note on neutrino.
 - (2) Define muons.
- (C) Write Answer of any **one**: 3
- (1) Write a note on mediator of an interaction.
 - (2) Describe the classification of elementary particles.
- (D) Write Answer of any **one**: 5
- (1) Write a note on particle and anti particles.
 - (2) What are the four fundamental interactions in nature?
- 4 (A) Write Answers: 4
- (1) Write the importance of wave function.
 - (2) Define normalized wave function.
 - (3) What does represent in Schrodinger's equation?
 - (4) Write any two basic postulates of wave mechanics.

- (B) Write Answer of any **one**: 2
 (1) Write the time dependent Schrodinger's equation.
 (2) Define eigen function.
- (C) Write Answer of any **one**: 3
 (1) Derive the relation between phase velocity and group velocity.
 (2) Describe various properties of wave functions.
- (D) Write Answer of any **one**: 5
 (1) Derive time independent Schrodinger's wave equation.
 (2) Derive an expression for the energy of particle in an infinite square well potential.
- 5** (A) Write Answers: 4
 (1) What is the velocity of packets?
 (2) What makes quantum mechanics different from classical mechanics?
 (3) Which materials are used in ruby LASER?
 (4) Which particles are gauge bosons?
- (B) Write Answer of any **one**: 2
 (1) Write the concept of Lepton conservation.
 (2) What are common decay modes of hyperons?
- (C) Write Answer of any **one**: 3
 (1) Derive an expression for de-Broglie wavelength.
 (2) Explain the semiconductor LASER with necessary diagram.
- (D) Write Answer of any **one**: 5
 (1) Derive an expression for probability distribution of particles using F-D statistics.
 (2) Derive M-B distribution law of velocity.
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