



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.

<b>1</b>	<b>(A) Write Answers:</b>	<b>4</b>
	(1) Define microscopic system. (2) Define distribution function. (3) What is significance of M-B distributive law. (4) Define phase point.	
	<b>(B) Write Answer of any one:</b>	<b>2</b>
	(1) Give the example of macroscopic system. (2) Write a note on classical and quantum statistics.	
	<b>(C) Write Answer of any one:</b>	<b>3</b>
	(1) Compare the M-B, B-E and F-D statistics. (2) Write a note on three statistical distribution function with necessary diagram.	
	<b>(D) Write Answer of any one:</b>	<b>5</b>
	(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 <b>one</b> :	2
	(1) Write the principle of LASER.	
	(2) Define inelastic atom-atom collision pumping method.	
	(C) Write Answer of any <b>one</b> :	3
	(1) Describe different pumping method used in LASER.	
	(2) Derive relation between Einstein's coefficients.	
	(D) Write Answer of any <b>one</b> :	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 $\pi$ -mesons?	
	(2) Define isospin.	
	(3) What is conservation law?	
	(4) How do we classify the elementary particles?	
	(B) Write Answer of any <b>one</b> :	2
	(1) Write a note on neutrino.	
	(2) Define muons.	
	(C) Write Answer of any <b>one</b> :	3
	(1) Write a note on mediator of an interaction.	
	(2) Describe the classification of elementary particles.	
	(D) Write Answer of any <b>one</b> :	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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