



JAI-003-0493006 Seat No. _____

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

Examination

November – 2019

**Paper - XII : Modern Physics - II
(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 margin indicate marks

1 Attempt any **seven** short questions : (two marks each) **14**

- 1) Write a note on π - Meson.
- 2) What is Heisenberg's Uncertainty Principal?
- 3) What are microscopic and macroscopic systems?
- 4) Define Phase Space and Phase Point.
- 5) Write a note on classical and quantum statistics.
- 6) Describe in brief Stimulated Absorption and Stimulated Emission.
- 7) The lifetime of an excited state of an atom is about 10^{-8} s. Calculate the minimum uncertainty in the determination of the energy of the excited state.
- 8) Write the Principle of LASER.
- 9) Describe the concept of Lepton Conservation.
- 10) Find the de Broglie wavelength associated with a 46 gm of golf ball with velocity 36 m/s.

2 (A) Write answers of any **two** : (five marks each) **10**

- 1) Derive the Time independent Schrodinger's wave equation in 3 - D.

- 2) Derive an expression for the energy of a particle in an infinite square well potential.
- 3) Find the expectation value $\langle P_x \rangle$ and $\langle x \rangle$ of the position of a particle trapped in a box L.
- 4) What is de-Broglie wave? Derive expression for its wavelength.
- (B) Write answer of any **one** : (Four marks each) **4**
- 1) Derive the relation between Phase Velocity and Group Velocity.
- 2) Derive the Time dependent Schrodinger's wave equation in 3-D.
- 3** (A) Write answers of any **two** : (Five marks each) **10**
- 1) State and explain the Law of equipartition of Energy.
- 2) Derive an expression for probability distribution of particles using Fermi Dirac statistics.
- 3) Write a detailed note on three statistical distribution functions with necessary diagrams.
- 4) Derive the expression of Maxwell's Boltzmann Distribution law.
- (B) Write answer of any **one** : (Four marks each) **4**
- 1) Compare Maxwell -Boltzmann (MB), Bose-Einstein (BE) and Fermi-Dirac (FD) Statistics.
- 2) Derive an expression for probability distribution for a Bose-Einstein system of particles.
- 4** (A) Write answers of any **two** : (Five marks each) **10**
- 1) Describe the construction and working of RUBY LASER.
- 2) Derive relations between Einstein's coefficients.
- 3) Explain Semiconductor LASER with necessary diagram.
- 4) Describe the construction and working of He-Ne LASER.

- (B) Write answer of any **one** : (Four marks each) 4
- 1) What is meant by Population Inversion?
 - 2) Write down various applications of LASER.
- 5 (A) Write answers of any **two** : (Five marks each) 10
- 1) Write a note on particle and anti particle.
 - 2) Describe the concept of strangeness conversation.
 - 3) Explain the classification of elementary particles.
 - 4) What are FOUR fundamental interactions in nature?
- (B) Write answer of any **one** : (Four marks each) 4
- 1) Write a note on mediator of an interaction.
 - 2) Write a short note on Isospin.
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