PBD-003-0493006   Seat No. _____

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

November / December - 2018

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)   Figures in the right side indicate marks.

1   Attempt any **seven** short questions : (Two marks each)   **14**
   (1)   Write down the principle of Heisenberg's uncertainty.
   (2)   What is Eigen function and Eigen value?
   (3)   Write the law of equipartition of energy.
   (4)   What are the bosons and fermions?
   (5)   Differentiate between classical and quantum statistics.
   (6)   Give the names of pumping method in LASER.
   (7)   Define : (1) Coherence and (2) Monochromaticity.
   (8)   Write some common decay modes of hyperons.
   (9)   Explain : Electromagnetic interactions.
   (10)   What is the concept of particle and antiparticle?

2   (a)   Write answers of any **two** :   **10**
   (1)   Derive an equation for the relation between Phase Velocity and Group Velocity.
   (2)   What is de-Broglie wavelength? Derive an equation for the de-Broglie wavelength.
   (3)   Derive the Time independent Schrodinger's wave equation in three dimensions.
   (4)   Derive an expression for the energy of a particle in an infinite square well potential.

(b) Write answer of any **one** : 4

    (1) Write down some applications of Heisenberg's uncertainty principle.

    (2) Write a detailed note on properties of the wave function.

3 (a) Write answers of any **two** : 10

    (1) Write a detailed note on distribution functions with necessary diagrams.

    (2) Derive an expression for probability distribution of particles using Fermi-Dirac statistics.

    (3) Compare Maxwell-Boltzmann (MB), Bose-Einstein (BE) and Fermi-Dirac (FD) Statistics.

    (4) Derive Maxwell's Boltzmann Distribution law for a system of n-particles.

(b) Write answer of any **two** : 4

    (1) What is phase space and phase point?

    (2) What is microscopic and macroscopic systems?

    (3) What is the indistinguishability of particles?

    (4) State and explain Liouville's theorem.

4 (a) Write answers of any **two** : 10

    (1) Describe the construction and working of He-Ne LASER.

    (2) Explain the principle of Semiconductor LASER with necessary diagram.

    (3) Describe the construction and working of Nd-YAG LASER.

    (4) What are Einstein's coefficients? State the relation between coefficients.

(b) Write answer of any one : 4

    (1) Write the applications of LASER in detail.

    (2) Explain in detail : absorption and emission in LASER.

5 (a) Write answers of any **two** : **10**

  (1) Describe the classification of Elementary Particles.

  (2) Describe the concept of Lepton and Baryon Conservation

  (3) Write notes on :

  (1) Isotopic spin and (2) Hypercharge.

  (4) Write a detailed note on particles and antiparticles.

(b) Write answer of any **one** : **4**

  (1) What are the fundamental interactions in nature ? Explain their relative range and strength.

  (2) Write a short note on $\pi - $Meson.

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