Exam.Code:0906
Sub. Code: 6668

2010

B.E. (Mechanical Engineering) Second Semester
APH-203: Quantum and Statistical Physics
(Common with ECE, IT and EEE)

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Unit.

x-x-x

I. Answer any five of the following:-
a) Differentiate between symmetric and antisymmetric wave functions.
b) An eigenfunction of the operator d^2/dx^2 is cos nx, where n=l,2,3... Find the corresponding eigen values.
c) Find out the total number of possible arrangements of 4 bosons and 4 fermions among 4 cells of equal a priori probability.
d) What are the results of Michelson Morley experiment?
e) Using Heisenberg uncertainity principle, show that an electron cannot exist inside the nucleus.
f) Why a trapped particle cannot be at rest quantum mechanically?
g) Explain thermionic emission using the concept of Fermi electrons. (5x2)

UNIT – I

II. a) Using the postulates of special theory of relativity, derive Lorentz transformation equations for space and time. Also discuss the failure of Galilean transformations.

b) Find the energy carried by a photon and an electron having momentum of 1.2 MeV/c. (7,3)

III. a) What is Compton effect? Show that the change in wavelength in Compton effect is independent of the type of target material.

b) What are matter waves? Show that matter waves travel with the velocity of the particle with which it is associated. (2x5)

IV. a) Prove that the results obtained by Davisson Germer experiment were in agreement with de-Broglie hypothesis.

b) Obtain the time independent form of Schrodinger's equation. What are its important implications? (2x5)

UNIT – II

V. a) Using Schrodinger equation, find out the normalized wave function for a particle confined to move along x axis in an infinitely rigid box of length L. Consider an electron in an infinitely rigid box of width 50 pico meter. Find the ground state and first excited energies of electron in eV.

P.T.O.

b) Derive the expression for transmission probability for a particle to tunnel a potential barrier of height V_0, with energy $E<V_0$? (2x5)

VI. a) What happens when a hydrogen atom is placed in a magnetic field?

b) Write the Schrodinger wave equation for the hydrogen atom in polar coordinates. Explain the origin and significance of the quantum numbers n, l and m_l. (2x5)

VII. a) Using Maxwell Bolzmann distribution, find the average molecular energy of an ideal gas.

b) Compare the three statistics. (2x5)

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