Exam.Code:0905
Sub. Code: 6645

1129

B.E. (Bio-Technology)
First Semester
APH-103: Quantum and Statistical Physics
(Common with IT and CSE)

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 briefly:-

a) What do you understand by the term ultraviolet catastrophe?

b) Doppler effect in light is a symmetric phenomenon. Justify.

c) How do you distinguish between macrostate and microstates of a system?

d) What do you understand by time dilation.

e) How do we define simultaneity in special theory of relativity?

f) What are the normalized wave functions. What significance do they hold?

g) Give two distinct features of Bose-Einstein and Fermi-Dirac Statistics. (5x2)

UNIT – I

II. a) Derive Lorentz transformation using basic postulates of special theory of relativity.

b) Why electron can't be accelerated indefinitely in the cyclotron. Justify using concepts of special theory of relativity. (6,4)

III. a) Derive the expression for length contraction.

b) Prove that $(E/c)^2 - p^2$ is invariant under Lorentz transformations. (2x5)

IV. a) Obtain time-independent form of Schrodinger's equation from first principle and show that energy quantization is embedded in this equation.

b) Derive Wein's displacement law from Planck's radiation law. (6,4)

UNIT – II

V. A particle of mass m and kinetic energy E is incident on a one dimensional simple harmonic potential well of height V_o, such that $E < V_o$. Solve Schrodinger's equation for this particle and obtain eign functions and eign values for this system. (10)

P.T.O.

VI. a) Discuss Stern Gerlach experiment emphasizing on its objective and outcome.

b) What is Zeeman effect? Discuss its origin. How does it affect the level structure of an atom? (2x5)

VII. What do you understand by microstate and macrostate of a system? Consider a statistical system comprising of extremely large number of identical particles. Show that this system has very high probability to remain in most stable macrostate in its state of equilibrium. (10)

x-x-x