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Exam.Code:0906
Sub. Code: 6668

1108
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 Part.*

x-x-x

I. Attempt any five of the following:-

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

b) Justify that no excited state of an atom can be mono energetic in nature.

c) How do you distinguish between microstate and macrostate in a physical system?

d) What were the conclusions of Michelson Money experiment?

e) What is Minkowski space and give its significance in relativity.

f) What are the basic requisites for wave function to represent the state of a physical system?

g) How do you understand the phenomenon of barrier penetration using energy time uncertainty principle? (5x2)

UNIT – I

II. a) Discuss Michelson-Morley experiment clearly giving its objective, experimental set-up, working and results.

b) Using Lorentz transformation, obtain the relation for time dilation. (7,3)

III. a) Derive the Lorentz transformations for different components of particles velocity.

b) Show that $x^2 + y^2 + z^2 - c^2t^2$ is invariant under Lorentz transformations. (6,4)

IV. a) Obtain steady state form of Schrodinger's equation and show that the energy quantization is a natural consequence of this equation.

b) An x-ray photon is found to have its wavelength doubled on being scattered through 90°. Find the wavelength and energy of the incident photon. (6,4)

P.T.O.

V. a) A particle of mass m and kinetic energy E is trapped in a one dimensional harmonic oscillator potential well of height V_o, such that $E<V_o$. Solve Schrodinger's equation for this particle and obtain its eignstates and eignvalues.

b) Prove the identity that $[x^2, p_x]=2ihx$ (7,3)

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

b) Write a brief note on Zeeman effect. (5,5)

VII. What is black body radiation? Using appropriate formalism of statistical physics, derive expression for Planck's radiation formula. (10)

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