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GSQ/D-20 1060

QUANTUM AND LASER PHYSICS

PH-501

Time : Three Hours] [Maximum Marks : 40

Note : Attempt *Five* questions in all, selecting *one* question from each Unit. Q. No. **1** is compulsory. All questions carry equal marks. Non-programmable calculator is allowed.

Compulsory Question

1. (a) Write down expression for Compton wavelength. **2**

(b) What are the conditions satisfied by a wave function ? **2**

(c) What is temporal coherence in laser ? **2**

(d) Explain the role of population inversiosn in laser. **2**

Unit I

2. (a) Describe Davisson and Germer's experiment to confirm wave nature of matter. **4**

(b) What is uncertainty principle ? Use it to describe that electron can not be part of nucleus. **4**

3. (a) Explain the working of Heisenberg γ-ray microscope. **4**

(b) Write down 1-D Schrödinger wave equation, develop 3-D time Schrödinger wave equation for a non-relativistic particle. Explain characteristics of wave function. **4**

Unit II

4. Solve the Schrödinger wave equation for a particle passing through a step potential, where $E>V_0$. Prove that T+R=1.

5. Describe the quantum theory of harmonic oscillator and solve the Schrödinger equation. Plot the energy levels. **8**

Unit III

6. (a) What are Einstein coefficient ? Derive an expression in relating them between them. **5**

(b) Describe the concept of spatial coherence. **3**

7. Derive threshold condition for laser oscillation. **8**

Unit IV

8. Discuss in detail the principle, construction and working of solid state Ruby laser. **8**

9. Discuss the important application of laser in Industries. **8**