Roll No. _____

(01-22 B)

5237

B.Sc. EXAMINATION

(Fifth Semester)

PHYSICS

PH-501

Quantum and Laser Physics

Time : *Three Hours* *Maximum Marks* : 40

Note There are nine questions in total. **Q. No. 1** is compulsory and have four parts of 2 marks each. *Four* more questions are to be attempted, selecting *one* question out of two questions set from each Unit. Use of scientific (non-programmable) calculator is allowed.

1 (a) Define quantization of energy and momentum 2

(b) Define orthogonality and normalization of function. 2

(c) Describe population inversion and laser pumping 2

(d) Describe optical properties of semiconductor 2

Unit I

2 (a) Define de-Broglie Hypothesis. Explain the Davisson and Germer experiment with conclusion 6

(b) Calculate de-Broglie wavelength of thermal neutrons at 27°C 2

3 (a) Explain diffraction of a beam of electrons by a slit 5

(b) Explain the non-existence of the electron inside the nucleus with the help of uncertainty principle 3

Unit II

4. Find the solution of Schrödinger equation for harmonic oscillator. Write wave equation for ground state and excited states. Explain zero point energy. 8

5. (a) Discuss the solution of Schrödinger wave equation and find the reflection and transmission coefficient in case of one-dimensional step potential E > 0. 6

   (b) Find the lowest energy state of an electron confined in a cubica[illegible] 1 A. 2

Unit III

6. (a) Discuss Einstein coefficients [illegible] the possibility of light amplification. [illegible]

   (b) Calculate the coherence length [illegible] beam for which bandwidth Δν [illegible]

7. Explain the threshold condition for laser emission, line broadening mechanism, homogeneous and inhomogeneous line broadening. 8

Unit IV

8. Discuss the principle, construction and working of semiconductor laser. 8

9. Discuss the principle, construction and working of Ruby laser. 8