

Unit IV

8. Describe the principle, construction, working of He-Ne Laser with suitable diagrams. 8
9. (a) Discuss the applications of lasers in various fields and provide examples of specific uses in medicine and industry, detailing the benefits of laser technology. 6
- (b) In a ruby laser, if the difference between the two energy levels involved in lasing is 1.79 eV, calculate the wavelength of the emitted laser light. 2

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B. Sc. EXAMINATION, 2025

(Fifth Semester)

PHYSICS

Paper IX

Quantum and Laser Physics

Time : 3 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. Use of non-programmable scientific calculator is allowed.

1. (a) State the significance of Planck's constant in quantum mechanics. 2
- (b) Describe, what is meant by quantization of energy. 2

- (c) What is population inversion, and why is it essential for laser action ? 2
- (d) Define the term 'semiconductor laser'. 2

Unit I

2. (a) Describe Photoelectric effect. Discuss the significance of the photoelectric effect in the development of quantum physics. 6
- (b) A photon with energy 3.0 eV strikes a metal surface with a work function of 2.2 eV. Calculate the kinetic energy of the emitted electron in joules. 2
3. What are the operators ? Deduce the time dependent one-dimensional Schrödinger wave equation. 8

Unit II

4. Solve the Schrödinger wave equation for a particle in a one-dimensional box and discuss the implications of the quantized energy states. 8
5. Find out reflection and transmission coefficients for a particle with energy E facing the one-dimensional potential step for the case $E < V_0$. Define the penetration depth. 8

Unit III

6. Find out the relations between Einstein's coefficients and explain how they lead to the possibility of amplification. 8
7. Write notes on the following :
- (a) Laser Pumping Methods 3
- (b) Main Components of LASER 3
- (c) Spatial Coherence. 2