

QP CODE: 26801767



Reg No :

Name :

INTEGRATED M.Sc. DEGREE EXAMINATION, APRIL 2026

Eight Semester

INTEGRATED M.Sc. BASIC SCIENCES-PHYSICS

CORE - IPH8CR01 - LASER AND NONLINEAR OPTICS

2021 Admission Onwards

B293733B

Time: 3 Hours

Weightage: 30

Part A (Short Answer Questions)

*Answer any **eight** questions.*

Weight 1 each.

1. Explain the ultraviolet catastrophe and how Planck resolved it.
2. Describe Einstein's coefficients and their significance in laser physics.
3. Compare the laser flux associated with a stable resonator and an unstable resonator.
4. Differentiate optomechanical and electro optic modulators.
5. Describe the working of electro optic shutters used in Q switching.
6. Describe any one method of passive mode locking in laser.
7. Differentiate solid state lasers and gas lasers with two examples for each.
8. Define dielectric susceptibility of the medium. Explain the polarization induced in a material in response to an electric field.
9. What is two photon absorption in nonlinear optics?
10. What do you mean by sum-frequency generation?

(8×1=8 weightage)

Part B (Short Essay/Problems)

*Answer any **six** questions.*

Weight 2 each.

11. Which are the conditions for sustained oscillation in laser. Explain.
12. Derive an expression for maximum output power by optimum output coupling in laser.
13. Explain the working of an optical resonator with neat sketch.





14. With necessary diagram explain the evolution of a Q switched laser pulse.
15. Explain the thermal lensing effect in laser and its challenges.
16. What is second harmonic generation in nonlinear optical processes? Second harmonic generation cannot occur in isotropic medium. Why?
17. Obtain the phase matching condition in parametric amplification.
18. With experimental arrangement and necessary diagrams describe frequency tuning.

(6×2=12 weightage)

Part C (Essay Type Questions)

*Answer any **two** questions.*

Weight 5 each.

19. Describe the collision and doppler broadening mechanisms in laser media.
20. Discuss three level laser system and obtain the rate equations.
21. Briefly explain the laser structure, excitation mechanism and applications of Carbon dioxide laser.
22. Explain electromagnetic formulation of nonlinear interactions and derive wave equation describing the propagation of electromagnetic wave in the presence of non linear polarization.

(2×5=10 weightage)

