

21P409

(Pages: 2)

Name:

Reg. No.....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2023

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY4 E13 – LASER SYSTEMS, OPTICAL FIBERS AND APPLICATIONS

(Physics)

(2019 Admission onwards)

Time: Three Hours

Maximum: 30 Weightage

Part A

Answer *all* questions. Each question carries 1 weightage.

1. What is meant by line broadening?
2. Draw and explain the energy level diagram of the He-Ne Laser.
3. Briefly explain fibre laser and give its advantage over other laser.
4. Explain the phenomenon of second and third harmonic generation.
5. Write a short note on z-scan technique.
6. Give the application of Lasers in medicine.
7. What is isotope separation?
8. Explain the term numerical aperture.

(8 × 1 = 8 Weightage)

Part B

Answer any *two* questions. Each question carries 5 weightage.

9. Analyse optical resonators using geometrical optics and hence obtain the condition to be satisfied for a stable resonator.
10. Explain the working of Nd - Yag laser and Semiconductor laser.
11. Describe the spatial frequency filtering. Explain the principle of holography.
12. Explain how optic fibre act as a cylindrical wave guide and obtain the wave equations in step index fibre.

(2 × 5 = 10 Weightage)

Part C

Answer any *four* questions. Each question carries 3 weightage.

13. Obtain expressions for Einstein's A and B coefficients.
14. For a typical Nd-Yag laser $n_0 = 1.82$; $t_{sp} = 0.23 \times 10^{-3} s$; $\lambda = 1.06 \mu m$; $g(\omega) = 7.5 \times 10^{11} Hz$. calculate the inversion required for a gain of $1 m^{-1}$.

15. A gas laser is generating a laser beam of 4mW. Calculate the number of photons emitted by the laser. The wavelength of the emitted radiation is 680nm.
16. Explain why it is difficult to get nonlinear effects using ordinary light sources.
17. Explain the uses of lasers in medicine.
18. Calculate the numerical aperture and the acceptance angle of an optical fiber with core refractive index 3.5 and cladding refracting index 3.45. Refractive index of the surrounding medium is 1.2
19. A step index fibre is made with a core of refractive index 1.52, a diameter of 295 μm and a fractional difference of 69×10^4 . It is operated at wavelength of 1.3 μm . Find the V number of modes that fiber will support.

(4 × 3 = 12 Weightage)
