D4APH2302 **(2 Pages)** **Name.....**
Reg.No.....

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2025
(Regular/Improvement/Supplementary)

PHYSICS
FPHY4E13 - LASER SYSTEMS, OPTICAL FIBRES AND APPLICATIONS

Time: 3 Hours **Maximum Weightage: 30**

Part A: Short answer questions. Answer *all* questions. Each carries *one* weightage.

1. What are the characteristic properties of a laser light?
2. Briefly explain mode locking.
3. Explain the working of a Ruby laser.
4. Elaborate on multi-photon absorption.
5. Explain briefly second harmonic generation.
6. Write a short note on laser induced fusion.
7. How does the propagation of light take place in an optical fibre?
8. Differentiate between step index and graded index fibre.

(8 × 1 = 8 weightage)

Part B: Essay questions. Answer any *two* questions. Each carries *five* weightage.

9. What is line broadening mechanism? Discuss the different types of line broadening mechanisms.
10. With the help of energy level diagram, explain the working of a He-Ne laser and Nd : YAG laser.
11. Explain the theory and experimental techniques of third harmonic generation.
12. Describe in detail the technique and applications of spatial filtering.

(2 × 5 = 10 weightage)

Part C: Problems. Answer any *four* questions. Each carries *three* weightage.

13. Derive the relation between Einstein's coefficients.
14. Find the ratio of populations of the two states in a He-Ne laser that produce light of wavelength 6328 A° at 27°C.
15. Explain the working of a semiconductor laser.

(P.T.O.)

16. Describe the Z-scan technique.

17. What is holography? Discuss the basic principle of holography.

18. Compute the cut off parameter and the number of modes supported by a fibre with core radius 25 μm and operating wavelength 1300 nm (given refractive index of core = 1.54 and cladding = 1.5).

19. Obtain the numerical aperture, acceptance angle and critical angle of the optical fibre having refractive index 1.50 and 1.45 for core and cladding respectively.

(4 × 3 = 12 weightage)