20P408 (Pages: 2) Name: ……..…...

Reg. No……..

FOURTH SEMESTER M.Sc. DEGREE EXAMINATION, APRIL 2022

(CBCSS - PG)

(Regular/Supplementary/Improvement)

CC19P PHY3 E13 - LASER SYSTEMS, OPTICAL FIBERS AND APPLICATIONS

(Physics - Elective Course)

(2019 Admission onwards)

Time: Three Hours Maximum: 30 Weightage

Section A

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

1. Describe the threshold condition for achieving population inversion.
2. Distinguish between Three-level and Four-level lasers. Which is more beneficial? Why?
3. The laser output can be obtained as a regular sequence of pulses. How?
4. What is Holography? Explain the process of recording a hologram.
5. Discuss industrial applications of laser.
6. Explain Symmetry requirement for second Harmonic generation.
7. Define attenuation of optical signal. Show that in an ideal fibre, attenuation is zero
8. Distinguish between step index monomode fibers and graded index monomode fibers. Briefly explain its advantages and disadvantages.

(8 × 1 = 8 Weightage)

Section B

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

9. What is line broadening? Explain different line broadening mechanisms
10. Explain the spatial frequency filtering and discuss any four applications
11. Describe in detail the z-scan technique. Explain how we can determine nonlinear absorption coefficient and nonlinear refractive index using it.
12. Derive wave equations for step index fibers. What are the advantages of fiber optic cable over conventional copper cables?

(2 × 5 = 10 Weightage)

Section C

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

13. Distinguish between stable and unstable resonators
14. Discuss Four wave mixing technique.
15. Describe the Q of a cavity and Q switching.

16. Explain in detail mode-locking technique.
17. What is the basic principle of an optical fiber? What are the possible energy losses in an optical fiber?
18. Calculate the relative population of two states of a laser that produces light of wavelength 5421 A^o at 300 K. $k_B = 8.6 \times 10^{-5}$ eV/K.
19. The length of a laser tube is 140 mm and the gain factor of the laser material is 0.000045/cm. If one of the cavity mirrors reflects 100 percentage of the light incident on it, what is the reflectance of the other cavity mirror?

(4 × 3 = 12 Weightage)

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