(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2022 ONLY)

SUBJECT CODE 22 PPS 411

REG.NO.

N.G.M.COLLEGE (AUTONOMOUS) : POLLACHI

END-OF-SEMESTER EXAMINATIONS : MAY – 2024

M.Sc. – PHYSICS **MAXIMUM MARKS: 50**

SEMESTER : IV **TIME : 3 HOURS**

LASERS AND NON LINEAR OPTICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
(Objective Questions with four Multiple Choices) (K1)

1. Laser beam is made of ……

   (a) highly coherent electrons (b) highly coherent photons
   (c) highly coherent phonons (d) none of the above

2. The method of population inversion in the HeNe laser is……

   (a) Molecular collision (b) Direction conversion
   (c) Optical pumping (d) Electron impact

3. The advantages of using laser drilling in industries is/are ……

   (a) it generates very low heat in the material during drilling
   (b) it is possible to drill at different angles
   (c) its accuracy and consistency are very high
   (d) all of the above

4. Third harmonic generation is possible in crystals that ……..

   (a) exhibits inversion symmetry (b) lack inversion symmetry
   (c) symmetry (d) none of the above

5. Stimulated Raman scattering occurs in _____

   (a) Forward direction (b) Backward direction
   (c) Upward direction (d) Forward and backward direction

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES. (K2)

6. What is the role of metastable state in laser action?
7. Define temporal coherence.
8. What is Holography?
9. What are two photon processes in non linear optics?
10. Differentiate Raman and Rayleigh scattering.

(CONTD …. 2)

SECTION – B (5 X 3 = 15 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K3)

11. a) Explain the principle of lasing action.

(OR)

b) Discuss the optical resonator and its action.

12. a) Briefly explain the characteristics of a laser beam.

(OR)

b) With energy level diagram explain the operation of Nd : YAG laser.

13. a) Enumerate the process of Q switching.

(OR)

b) Write a note on distributed feedback laser.

14. a) How does third harmonic differ from second harmonic generation?

(OR)

b) Explain parametric light oscillator.

15. a) Explain multi photon ionization.

(OR)

b) What is the Spin Flip Raman Laser and how does it utilize Raman transitions for laser operation?

SECTION – C (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS.

(K4 (Or) K5)

16. a) Derive Einstein's relation.

(OR)

b) Derive the rate equation for a three level laser.

17. a) Explain the working of He Ne laser with a suitable diagram.

(OR)

b) Describe the laser action in CO_2 with suitable energy level diagram.

18. a) Explain the different mode locking techniques.

(OR)

b) Discuss the applications of laser in medicine.

19. a) Briefly explain the phase matching achieved in second harmonic generation.

(OR)

b) Discuss the phase conjugate optics in detail.

20. a) Describe stimulated Raman effect.

(OR)

b) Discuss Doppler-free two-photon spectroscopy and its significance.