ARREAR **(NO. OF PAGES: 2)**

(FOR THE CANDIDATES ADMITTED DURING THE ACADEMIC YEAR 2021-22 ONLY)

SUBJECT CODE **21 PPS 411** / **20 PPS 412**

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

END-OF-SEMESTER EXAMINATIONS : MAY – 2023

M.Sc. – PHYSICS **MAXIMUM MARKS: 70**

IV SEMESTER **TIME : 3 HOURS**

LASERS AND NON-LINEAR OPTICS

SECTION – A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

MULTIPLE CHOICE QUESTIONS. (K1)

1. At thermal equilibrium number of atoms presented at ground level and excited levels _____.

   a) are equal b) are not equal
   c) sum of ground level and excited level atoms equal to the total number of atom
   d) atoms in excited states are equal to the total number of atom

2. The output Wave length of CO_2 laser is _____.

   a) 3.6 µm b) 10.6 µm c) 6943A^o d) 6928 A^o

3. The method of Q-switching involved in electro-optical shutters is _____.

   a) Kerr effect b) phase matching
   c) synchronous motor method d) self-focusing

4. In second harmonic generation _____.

   a) the wavelength is doubled b) frequency is halved
   c) frequency unchanged d) the wavelength is halved

5. CARS is _____.

   a) Collimated anti-Stokes Raman scattering b) Coherent and Stoke Raman scattering
   c) Coherent anti-Stokes Raman scattering d) Coherent anti-Stokes Rayeligh scattering

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

6. How will you denote the Einstein coefficient for stimulated absorption?
7. Most widely used dye in dye laser is what?
8. Define the term hologram.
9. What type of harmonic generation one can expect in centrosymmetric materials?
10. Differentiate Raman scattering from Rayleigh scattering.

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SECTION – B (5 X 5 = 25 MARKS)

ANSWER EITHER (a) OR (b) IN EACH OF THE FOLLOWING QUESTIONS. (K3)

11. a) What are Einestein coefficient? Deduce the expression for the ratio between the stimulated and spontaneous emission processes.

(OR)

b) Write a short note on optical resonators and their functions

12. a) List the properties of a Laser beam. and discuss in detail

(OR)

b) Explain the construction and working of an excimer Laser.

13. a) Deduce the expression for peak power produced during the pulse of a Q- switched laser.

(OR)

b) Discuss the role of lasers in welding and cutting.

14. a) Explain the phenomenon of self focusing.

(OR)

b) Explain two-photon processes through an experiment.

15. a) Write about stimulated Raman Scattering.

(OR)

b) Explain the following : i) laser cooling. ii) trapping of neutral atom

SECTION – C (4 X 10 = 40 MARKS)

ANSWER ANY FOUR OUT OF SIX QUESTIONS
(16th QUESTION IS COMPULSORY AND ANSWER ANY THREE QUESTIONS (FROM Qn. No : 17 to 21) (K4 (or) K5)

16. Write a note on the molecular gas laser and explain the working of the CO_2 laser with an energy level diagram.

17. What are laser rate equations? Construct Laser rate equation for three-level laser systems and attain the condition for population inversion.

18. Explain the working of the He-Ne laser with construction details. Elaborate on its laser activity through energy level diagram.

19. Describe any eight applications of lasers in various fields.

20. Arrive the phase matching criterion for frequency doubling process in crystals.

21. Elaborate classical and quantum mechanical treatment of hyper Raman Effect.

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