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(FOR THE CANDIDATES ADMITTED DURING DURING THE ACADEMIC YEAR 2020-21 ONLY)

SUBJECT CODE 20PPS412

REG.NO.

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

END-OF-SEMESTER EXAMINATIONS: JULY-2022

M.Sc. PHYSICS **MAXIMUM MARKS: 70**

SEMESTER : IV **TIME : 3 HOURS**

CORE XII: LASERS & NON-LINEAR OPTICS

SECTION - A (10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.
MULTIPLE CHOICE QUESTIONS. **(K1)**

1. The need to achieve population inversion is _____
   a) To excite most of the atoms b) To bring most of the atoms to ground state
   c) To achieve stable condition d) To reduce the time of production of laser
2. The type of laser which is used for the generation of laser pulse is _____
   a) Ruby laser b) Carbon dioxide laser
   c) Helium neon laser d) Nd- YAG laser
3. The characteristic of LASER which allows it to be used in holography is _____
   a) Intensity b) Directionality
   c) Coherency d) Monochromaticity
4. When the wave vectors of the fundamental and second-harmonic radiation of light waves are equal then it is called as _____
   a) Optical mixing b) Phase matching
   c) Self focusing of light d) Frequency up conversion
5. Which of the following cannot be conserved during Raman scattering?
   a) Total Energy b) Momentum
   c) Electronic Energy d) Kinetic Energy

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

6. Define population inversion.
7. What is an excimer laser?
8. What is cavity dumping of laser?
9. What is meant by optical mixing?
10. Give an advantage of spin flip Raman laser.

SECTION – B (5 X 4 = 20 MARKS)

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

11. a) Deduce laser rate equations for three and four level systems.

(OR)

b) Give an account of optical resonator and its action.

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12. a) Write a short note on dye laser and fiber laser.

(OR)

b) List and explain the characteristics of laser.

13. a) What is mean by Q-factor of a laser? Discuss the different methods of Q switching.

(OR)

b) Explain how laser is used for material processing.

14. a) Write a short note on second and third harmonic generation of light.

(OR)

b) Discuss the experimental study of two photon process in non-linear optics.

15. a) Outline the elementary ideas on saturation absorption spectroscopy.

(OR)

b) What are Rayleigh and Raman scattering? Explain.

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. Give an account of helium-neon and free electron laser.

17. Deduce Einstein's relations for large stimulated emission and light amplification of laser.

18. Discuss the working of a Ruby laser and semiconductor diode laser with a relevant sketch.

19. Explain the applications of laser in isotope separation and holography.

20. Briefly explain (i) Multi quantum photo electric effect, (ii) Parametric light oscillator.

21. Write a brief note on, (i) Doppler free two photon spectroscopy, (ii) Stimulated and hyper Raman effect.

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