

(FOR THE CANDIDATES ADMITTED

SUBJECT CODE

24 PPS 411

DURING THE ACADEMIC YEAR 2024-25 ONLY)

REG.NO.:

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

END-OF-SEMESTER EXAMINATIONS : MAY– 2026

M.Sc. – PHYSICS

MAXIMUM MARKS: 75

IV SEMESTER

TIME : 3 HOURS

LASERS AND NON-LINEAR OPTICS

SECTION – A

(10 X 1 = 10 MARKS)

ANSWER THE FOLLOWING QUESTIONS.

(K1)

COURSE NAME 24PPS411 Lasers and Non-Linear Optics

MAXIMUM

1. The Einstein coefficient used for spontaneous emission in laser action is
a) B_{12} b) A_{21} c) A_{22} d) B_{12}
2. The output Wave length of CO_2 laser is
a) $3.6 \mu\text{m}$ b) $10.6 \mu\text{m}$ c) $6943\text{\AA}$ d) $6928\text{\AA}$
3. The phenomenon involved in Q-switching in an electro-optical shutters is
a) Kerr effect b) phase matching
c) synchronous motor method d) self-focusing
4. Which one of the followings normally used to identify second harmonic generation in a crystal ?
a) ruby laser b) Nd-YAG laser c) excimer Laser d) CO_2 laser
5. Spin Flip Raman laser is
a) ultra violet laser b) infra red laser
c) tunable infra red laser d) amplified ultraviolet laser

ANSWER THE FOLLOWING IN ONE (OR) TWO SENTENCES

(K2)

6. What is optical pumping?
7. Define the term mono chromaticity.
8. What is known as Q-factor.?
9. Mention any two second harmonic generating crystals.
10. CASRS is an acronym of what in NLO studies?

(CONTD 2)

SECTION – B

(5 X 5 = 25 MARKS)

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

11. a) Write a short note on line shape function.
(OR)
b) Mention various types of pumping schemes. Explain about optical pumping scheme with transition diagram.
12. a) Classify the types of coherence with example.
(OR)
b) Describe the construction and working of Fiber Laser,.
13. a) Explain cavity dumping.
(OR)
b) Discuss the role of laser in isotope separation with an example.
14. a) Explain the process of self-focusing in a NLO material .
(OR)
b) Explain frequency up conversion .
15. a) Explain Photo Acoustic Raman spectroscopy and mention its importance.
(OR)
b) Explain the multi photon ionization in a nlo material

SECTION – C

(5 X 8 = 40 MARKS)

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

(K4 (Or) K5)

16. a) What are laser rate equations? Construct Laser rate equation for three-level laser systems and attain the condition for population inversion
(OR)
b) Define an optical resonator and derive the Schawlow-Townes condition for laser threshold oscillation
17. a) Explain the construction and working of Nd-YAG laser device with energy level diagram. Mention some of its important applications in research and industry.
(OR)
b) Give the theory and functions of the following Laser
i) Excimer Laser ii) X-ray Laser
18. a) What is mode locking? List the various types of mode locking techniques? Give the theory behind mode locking technique.
(OR)
b) What are the applications of laser in industries and medicine? Explain with techniques involved.
19. a) What is harmonic generation? Explain the theory behind harmonic generations in symmetric and asymmetric crystals and discuss the role of second harmonic generations in nonlinear crystals.
(OR)
b) What is known as multiphoton process? Explain the phenomenon of two photon process with an illustration.
20. a) Elaborate classical and quantum mechanical treatment of hyper Raman Effect.
(OR)
b) Describe the basic mechanism involved in laser cooling and trapping of neutral atoms with an illustration.
