

[4]

SECTION 'C'

$4 \times 10 = 40$

Long Answer questions (Word limit 400-450 words.)

- Q. 1.** Discuss the Einstein's quantum theory of radiation & explain Einstein's coefficients.

OR

Discuss a two-level system laser pumping.

- Q. 2.** Explain the condition for laser action in semiconductor.

OR

Discuss the mechanism of CO₂ laser.

- Q. 3.** What is mode locking operation? Write the expression for intensity of mode locking and explain it.

OR

Discuss the phase matching for second harmonic wave and find out the criterion for phase matching.

- Q. 4.** Discuss the quantum theory of two photon processes.

OR

What is hyper Raman effect? Give the classical explanation of hyper Raman effect.

[1]

ROLL NO.....

PHY. 202/21

II SEMESTER EXAMINATION, 2021

M.Sc. (PHYSICS)

PAPER-II

LASER PHYSICS & APPLICATION

TIME: 3 HOURS

**MAX.- 80
MIN.- 16**

Note: The question paper consists of three sections A, B & C. All questions are compulsory.

Section A- Attempt all MCQ questions

Section B- Attempt one question from each unit.

Section C- Attempt one question from each unit.

SECTION 'A'

$2 \times 8 = 16$

Multiple Choice Questions

1. A laser beam consist of
 - (a) light material particles
 - (b) electrons
 - (c) lightly coherent
 - (d) cosmic rays
2. Which level must have longer life time in laser action in three level scheme?
 - (a) ground energy level
 - (b) first excited level
 - (c) second excited level
 - (d) third excited level

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3. The population inversion in CO₂ laser is produced by –
(a) electric discharge (b) inelastic atom-atom collision
(c) chemical reaction (d) optical pumping
4. The population inversion in helium neon laser is produced by -
(a) photon excitation (b) chemical excitation
(c) inelastic atomic collisions (d) chemical reaction
5. Q-switching is used to get -
(a) a continuous pulse
(b) a giant laser pulse for a short duration
(c) a giant laser pulse for a long duration
(d) to stop the incoming laser beam
6. The laser is said to be a mode-locked laser-
(a) modes are forced to oscillate with their phases locked
(b) forced to oscillate with intensity locked
(c) changing phase & amplitude locked
(d) amplitude change & frequency locked
7. The characteristics of laser used in material processing are -
(a) Spatial coherence and collimation
(b) temporal coherence and low power
(c) monochromaticity and temporal coherence
(d) monochromaticity and low intensity
8. Most commonly used laser for precise measurement is -
(a) Argon ion laser (b) Helium neon laser
(c) Solid state laser (d) Dye laser

[3]

$4 \times 6 = 24$

SECTION 'B'

Short Answer Type Questions

- Q.1.** Explain the quantum mechanical treatment of line broadening mechanism.

OR

Derive the expression for number of modes for unit volume.

- Q.2.** Draw energy level of Nd:YAG Laser and explain its mechanism.

OR

Draw energy level diagram of He-Ne laser and explain its mechanism.

- Q.3.** Explain the phenomenon of laser amplifiers.

OR

Explain harmonic generation & hence write dipole moment for different harmonic of polarization.

- Q.4.** Discuss multi quantum photoelectric effect.

OR

Discuss the laser application in isotope separation.