

Roll No.

(05/25)

15433

M.Sc. EXAMINATION

(For Batch 2021 & Onwards)

(Fourth Semester)

PHYSICS

MSc/Phy/4/SEC3(A)

Laser and Spectroscopy-II

Time : Three Hours

Maximum Marks : 70

Note : Attempt *Five* questions in all. Q. No. 1 is compulsory. Attempt *one* question from each Unit.

(Compulsory Question)

1. Explain the following in brief : **5×2=10**

(i) What is spatial hole burning ?

(ii) How is organic liquid dye cell works as a passive mode locking device ?

(3-10/I) B-15433

P.T.O.

- (iii) What is sum frequency generation ?
- (iv) Two prominent lasing transitions of CO_2 laser.
- (v) What is Kerr effect ?

Unit I

- 2. Derive laser rate equations and population inversion for the four energy level laser system. As an example explain energy level diagram of He-Ne laser. 15
- 3. Define efficiency of laser. What is overall efficiency ? Discuss various factors for laser efficiency. Give efficiency values of any five different lasers. 15

Unit II

- 4. (a) Explain structure, working, efficiency and applications of Nd : YAG laser. 10

(b) Discuss gas dynamic CO_2 laser along with structure. 5

5. Discuss structure, energy level diagram, working, efficiency and applications of Ar^+ ion laser. 15

Unit III

6. What is mode locking for a laser ? Set up the mode locking theory of laser. 15

7. (a) Discuss magneto-optic and acousto-optic effects based Q-switching shutters. 10

(b) Explain synchronous pumping in laser cavity as an active mode locking technique. 5

Unit IV

8. Explain the structure, principle, working procedure and applications of high sensitive fluorescence excitation spectroscopy method. 15

9. Explain the structure, principle, working procedure and applications of high sensitive intracavity absorption spectroscopy methods using :

- (i) Single mode operation 7
- (ii) Multimode mode operation. 8

