PG (CBCS) EVEN SEMESTER EXAMINATION, 2023

PHYSICS

4th Semester

Course No. : PHYCC - 404 D

(Non-linear Optics and Laser Spectroscopy-II)

Full Marks : 70

Pass Marks : 28

Time : 3 hours

The figures in the margin indicate full marks for the questions

(Answer five questions, taking one from each unit)

UNIT - I

1. What is Q-switching? Show that the output power of a Q-switched pulse can be expressed as

    4+10=14

    $$P_{out} = (1 - R_{oc})\, hvn\, V\, \frac{1}{\tau_c}$$

    (symbols have their usual meaning)

2. Explain analytically the formation of laser modes in active mode locked lasers.   14

UNIT - II

3. (a) Obtain the expression   4+2=6

$$\Delta N = \frac{\Delta N^0}{1 + S}$$

in a closed two level system and define the saturation parameter.

(symbols have their usual meaning)

(b) Give a quantiative analysis of saturation broadening of homogeneous line profile.   8

4. Explain "hole burning" in a Doppler broadened inhomogeneous line profile. How can it be detected?
10+4=14

UNIT - III

5. (a) Define two photon absorption using appropriate energy level diagram.   4

(b) Explain the technique of Doppler free multiphoton absorption? Discuss how it differs from saturation spectroscopy technique.
7+3=10

6. Give a physical interpretation of quantum beats and explain how energy interval ΔE between levels can be determined from fluorescence decay in quantum beat spectroscopy.   6+8=14

UNIT - IV

7. (a) Write some basic difference between spontaneous and stilulated Raman effects. 4

(b) What is CARS? Describe an arrangement of CARS experiment with schematic diagram.
5+5=10

8. Show that "stimulated Raman - stokes emission is a gain process and anti-stokes experiences alternation" using non-linear polarization equations.   14

UNIT - V

9. Write short notes on the following :   7x2=14

(a) Optical cooling of atoms

(b) Optical trapping of atoms.

10. Explain the phenomenon of optical levitation of atoms using a schematic diagram.   14

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