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The Assam Royal Global University, Guwahati
Royal School of Applied & Pure Sciences
M.Sc. Physics 4th Semester
Semester End Examination, June 2023
Subject name: Non-Linear Optics and Laser Spectroscopy-II
Subject code: PHY014D401

Time: 3Hours

Maximum Marks: 70

Note: Attempt all questions as per instructions given.
The figures in the right-hand margin indicate marks.

Section – A

1. Attempt **all** questions. (Maximum word limit 50) 2 x 8
- a. What do you understand by spontaneous scattering process?
 - b. How do you define Stokes scattering?
 - c. What does the word CARS stand for in nonlinear optics?
 - d. When do you refer a term as saturation intensity in nonlinear optics?
 - e. State the most distinctive characteristic of laser emission.
 - f. What do you understand by threshold of lasing?
 - g. State cavity line-width equation in pulsed equation.
 - h. What are the advantages of ultrashort pulses over normal pulse?

Section – B

2. Attempt **any two** of the following: 6x 2
- a. Write briefly about Stimulated Raman Scattering with necessary diagram.
 - b. Briefly discuss generation of Anti-Stokes radiations,
 - c. Derive the Stokes and Anti-Stokes coupling equation in Stimulated Raman Scattering.
3. Attempt **any two** of the following: 7 x 2
- a. If absorption coefficient (α) is a function of nonlinear absorption (P_0) in nonlinear spectroscopy, justify your answer.
 - b. Discuss longitudinal and transverse relaxation time in Hole burning.
 - c. Doppler-Free Multiphoton Spectroscopy is a nonlinear phenomenon, explain your view.
4. Attempt **any two** of the following: 7 x 2
- a. What are resonators? Discuss the different types of resonators.
 - b. In an optical cavity discuss the stability of a resonator.
 - c. Discuss the properties of Gaussian beam in laser.
5. Attempt **any two** of the following: 7 x 2
- a. In an optical system derive the wave equation of Ultrashort laser.
 - b. Briefly explain High Harmonic Generation in an intense field nonlinear optics
 - c. Discuss the interpretation of the Ultrashort pulse propagation equation.