



K19U 0134

Reg. No.: .....

Name: .....

**VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Improv.)**  
**Examination, April 2019**  
**(2014 Admission Onwards)**  
**Core Course in Physics**  
**6B12 PHY : PHOTONICS AND SPECTROSCOPY**

Time : 3 Hours

Max. Marks : 40

**Instructions :** Write answers in **English** only.

**SECTION – A**

Answer **all** – Very short answer type – **Each** question carries **one** mark.

1. The basic principle involved in lasing action is \_\_\_\_\_
2. Optical fibers can carry optical frequencies of about \_\_\_\_\_
3. The basic technique in holography is \_\_\_\_\_
4. The rotational spectroscopy is in the region of \_\_\_\_\_

**SECTION – B**

Answer **any seven** – Short Answer Type. **Each** question carries **two** marks.

5. What are the essential components of a laser ? Explain their functions.
6. Give the necessity of cladding in the optical fiber.
7. Mention any four applications of optical fiber.
8. Briefly explain collision broadening.
9. What is a linear molecule ? Give an example.
10. What is population inversion ?
11. What are hot bands ? Why they are called so ?
12. What is Born-Oppenheimer approximation ?
13. Briefly explain how hologram is constructed.
14. Explain the principle of working of a microwave oven.

P.T.O.



## SECTION – C

Answer **any four** – Short essay/problem type – **Each** question carries **three** marks.

15. Calculate the angle of acceptance of a given optical fiber, if the refractive indices of the core and cladding are 1.563 and 1.498 respectively.
16. The average spacing between successive rotational line of carbon monoxide is  $3.8626 \text{ cm}^{-1}$ . Determine the transition which gives the most intense spectral line at 300K.
17. The fundamental and first overtone transition of  $^{14}\text{N}^{16}\text{O}$  are centered at  $1876.06 \text{ cm}^{-1}$  and  $3724.2 \text{ cm}^{-1}$  respectively. Evaluate the equilibrium vibration frequency, the anharmonicity constant and zero point energy.
18. Outline the effect of isotopic substitution on the rotational spectra of molecules.
19. Calculate the ratio of spontaneous emission to stimulated emission for radiation 600 nm at 2500 K. Is lasing possible ?
20. In a ruby laser the ruby rod contain a total of  $3 \times 10^{19}$  chromium ions. If laser emits lights of  $6943 \text{ \AA}$  wavelength, find the energy of one emitted photon and the total energy available per laser.

## SECTION – D

Answer **any two** – Long essay type – **Each** question carries **five** marks.

21. Explain with the help of an energy level diagram the working of a He-Ne laser.
22. Discuss the theory of vibrating diatomic molecule.
23. A) Deduce an expression for acceptance angle of an optical fiber.  
B) Using ray theory, derive the condition for transmission of light in an optical fiber.
24. Discuss the theory of the origin of pure rotational spectrum of a diatomic molecule.