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Reg. No. : ....

Name : ....

VI Semester B.Sc. Degree (CBCSS-Supple./Improv.) Examination, April 2022
(2016 – 2018 Admissions)
CORE COURSE IN PHYSICS
6B12 PHY : Photonics and Spectroscopy

Time : 3 Hours

Max. Marks : 40

Instruction : Write answers in English only.

SECTION – A

(Answer all – Very short answer type – Each question carries one mark)

1. Give the formula for numerical aperture.

2. The wavelength of light from Ruby laser is _____

3. The main information that can be derived from a rotational spectrum is_____

4. When $\Delta J = -1$ in a vibrating rotor, then the lines corresponding to it is called _____

SECTION – B

(Answer any seven – Short answer type – Each question carries two marks)

5. Diatomic molecules such as CO, HF will show rotational spectrum whereas N_2, O_2,... will not. Why ?

6. Write any two characteristics of stimulated emission.

7. Define the terms : active medium and pumping.

8. Give any two properties of hologram.

9. Distinguish between step index and graded index fibers.

10. The frequency of OH stretching vibration in CH_3OH is 3300 cm^{-1}. Estimate the frequency of OD stretching vibration in CH_3OD.

P.T.O.

11. What are Einstein co-efficients ?

12. Mention the advantages of optical fiber sensor over conventional sensors.

13. What are the threshold conditions ?

14. Give the IR selection rules.

SECTION – C

(Answer any four – Short essay/problem type – Each question carries three marks)

15. Explain the principle of holography.

16. Explain collision broadening and Doppler broadening.

17. The $J = 0 \rightarrow 1$ transition in HCl occurs at 20.68 cm^{-1} regarding the molecule to be a rigid rotator. Calculate the wavelength of the transition $J = 14 \rightarrow 15$.

18. In a ruby laser the ruby rod contain a total of 3×10^{19} chromium ions. If laser emits lights of 6943 A° wavelength, find the energy of one emitted photon and the total energy available per laser.

19. A step index fiber is made with core of refractive index 1.52, a diameter of 29 μm and a fractional difference index of 0.0007 is operated at a wavelength of 1.3 μm. Find the V-number and the number of modes that the fiber will support.

20. Outline the effect of isotopic substitution on the rotational spectra of molecules.

SECTION – D

(Answer any two – Long essay type – Each question carries five marks)

21. Describe the working of semiconductor laser. Write any four advantages.

22. Briefly explain an optical fiber. Using ray theory discuss the mechanism of transmission of light within an optical fiber.

23. Discuss the theory of the origin of pure rotational spectrum of a diatomic molecule.

24. Explain the vibrational spectrum of a diatomic molecules considering it as an anharmonic oscillator.