K17U 0379

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – Regular) Examination, May 2017
CORE COURSE IN PHYSICS
6B12 PHY : Photonics and Spectroscopy
(2014 Admn.)

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. The angle of incidence for which the corresponding angle of refraction is 90° is called _____
2. The construction of hologram made use of the principle of _____
3. The separation between any two adjacent lines in a P branch or R branch is _____
4. In He-Ne laser population inversion is achieved by _____ **(1×4=4)**

SECTION – B

Answer **any seven**. Short answer type. **Each** question carries **two** marks :

5. Discuss any two applications of holography.
6. Define numerical aperture. Deduce an expression for it.
7. What are the advantages of a hologram over ordinary photograph ?
8. Briefly explain how hologram is constructed.
9. What is meant by stimulated emission ? Explain with a two level diagram.
10. What are the essential components of a laser ? Explain their functions.
11. What are hot bands ? Why they called so ?

P.T.O.

12. Classify molecules according to their rotational spectra.

13. Explain the principle of working of a microwave oven.

14. Mention the advantages of optical fiber sensor over conventional sensors. **(2×7=14)**

SECTION – C

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

15. The average spacing between successive rotational line of carbon monoxide is 3.8626 cm^{-1}. Determine the transition which gives the most intense spectral line at 300 K.

16. The fundamental and first overtone transitions of $^{14}N^{16}O$ are centred at 1876.06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibrational frequency, the unharmonicity and the exact zero point energy.

17. The He-Ne system is capable of lasing at 3.3913 μ m. Determine the energy difference in eV between the upper and lower of this wavelength.

18. A fiber cable has an acceptance angle of 30° and a core index of refraction 1.4; calculate the refractive index of the cladding.

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

20. At what temperature are the rates of spontaneous and stimulated emission equal ? Assume $\lambda = 5000$ A°. **(3×4=12)**

SECTION – D

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

21. Explain the principle, construction and working of ruby laser with suitable diagram.

22. Describe the theory of diatomic vibrating rotator with energy level diagrams.

23. Discuss about the effect of isotopic substitution and intensity of spectral lines in rotational spectroscopy.

24. Briefly explain an optical fiber. Using ray theory discuss the mechanism of transmission of light within an optical fiber. **(5×2=10)**
