



K24U 0404

Reg. No. :

Name :

Sixth Semester B.Sc. Degree (CBCSS – Supplementary/One Time Mercy
Chance) Examination, April 2024
(2014 to 2018 Admissions)
CORE COURSE IN PHYSICS
6B12PHY : Photonics and Spectroscopy

Time : 3 Hours

Max. Marks : 40

SECTION – A

Answer **all** the questions. Very short answer type. **Each** question carries **1** mark.

1. The angle of incidence for which the corresponding angle of refraction is 90° is called _____
2. The separation between any two adjacent lines in a P branch or R branch is _____
3. The selection rule for rotation level transition is _____
4. The inner part of optical fiber is called _____ (4×1=4)

SECTION – B

Answer **any 7** questions. Short answer type. **Each** question carries **2** marks.

5. Distinguish between photograph and hologram.
6. What is meant by pumping ? Name any two pumping methods.
7. Molecules such as CO and HF show rotational spectrum. Why ?
8. Explain any two applications of holography.
9. What are hot bands ? Why they called so ?
10. Explain the principle of working of a microwave oven.
11. What is meant by numerical aperture of an optical fiber ?
12. How will you evaluate the bond length or a molecule from rotational constant ?

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13. Define cavity life time.
14. Define numerical aperture. Deduce an expression for it. (7×2=14)

SECTION – C

Answer **any 4** questions. Short essay/problem type. **Each** question carries **3** marks.

15. The fundamental and first overtone transitions of CO are centered at 2143.3 cm^{-1} and 4260.0 cm^{-1} . Calculate the equilibrium oscillation frequency, anharmonicity constant and force constant of the molecule.
16. A ruby laser beam with wavelength 690 nm is incident on an object. The power of the beam is 25 mW and diameter is 1.25 mm. Determine the intensity of the laser beam falling on the object.
17. Show that the spacing of vibrational energy levels of a diatomic molecule as a harmonic oscillator are equally spaced.
18. The first line in the rotational spectrum of carbon monoxide has a frequency of 3.8424 cm^{-1} . Calculate the rotational constant and hence the C-O bond length in carbon monoxide. Avogadro number is $6.022 \times 10^{23}/\text{mol}$.
19. The refractive indices of core and cladding of an optical fiber are 1.54 and 1.50 respectively. Calculate the numerical aperture and acceptance angle of the fibre.
20. Briefly explain the working principle of a CO_2 laser. (4×3=12)

SECTION – D

Answer **any 2** questions. Long essay type. **Each** question carries **5** marks.

21. Obtain an expression for the rotational energy levels of a diatomic molecule taking it as a rigid rotator. Discuss its spectrum and the relevant selection rule.
22. Briefly explain an optical fiber. Using ray theory, discuss the mechanism of transmission of light within an optical fiber.
23. What are the properties of Laser ? Define Einstein co-efficient. Derive the relation between Einstein co-efficient.
24. What is the principle of holography ? Describe the recording and reconstruction process of holography with the help of suitable diagrams. (2×5=10)