



K16U 0214



Reg. No. :

Name :

VI Semester B.Sc. Degree (CCSS – Reg./Supple./Improv.)

Examination, May 2016

Core Course in Physics

6B12 PHY : PHOTONICS & SPECTROSCOPY

(2012 Adm. Onwards)

Time : 3 Hours

Max. Weightage : 30

PART – A

Answer **all** questions. **Each** bunch carries 1 W.

1. i) Light rays are propagated through an optical fiber by the mechanism of
 - a) Refraction
 - b) Reflection
 - c) Total internal reflection
 - d) Diffraction
- ii) The light gathering ability of the optical fiber is determined by
 - a) Cladding
 - b) Numerical aperture
 - c) Grading
 - d) Guiding
- iii) Dye lasers are also called
 - a) Solid state lasers
 - b) Tunable lasers
 - c) Fusion lasers
 - d) Switched lasers
- iv) The intensities of the antistoke lines are much
 - a) Weaker than the stokes lines
 - b) Much greater than the stokes lines
 - c) Same as stokes lines
 - d) None of these
2. i) Transitions between rotational levels within the same vibrational level give spectrum in the
 - a) Visible region
 - b) Ultraviolet region
 - c) Infrared region
 - d) Far infrared region

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- ii) The Doppler broadening is
- a) Homogeneous b) Inhomogeneous
c) Pressure broadening d) Power broadening
- iii) When all the three principal moments of inertia of a molecule are equal, it is called
- a) Spherical top b) Linear molecule
c) Asymmetric top d) Non linear molecule
- iv) At the lowest vibrational level the vibrational energy is
- a) Zero b) Not zero
c) Equal to dissociation energy d) Infinity

(2×1=2)

PART – B

Answer **any six** questions. **Each** question carries **1 W**.

1. What are Einstein's Coefficients ?
2. What is meant by rate equation ? What are its advantages ?
3. What is population inversion ? Why is it necessary for lasing action ?
4. What is an optical resonator cavity ? What is its role in a laser ?
5. Explain the principle of Holography.
6. In a He-Ne laser an increase in diameter of the laser may reduce lasing efficiency. Why ?
7. What is an optical fiber ?
8. What are the advantages of an optical fiber in communication systems ? (6×1=6)

PART – C

Answer **any nine** questions. **Each** question carries **2 W**.

1. Calculate the energy difference in eV between two energy levels of Ne atoms of a He-Ne laser, the transition between which result in the emission of a light of wavelength 632.8 nm. Find also the number of photons emitted per second, if the optical power output is 2 mW.



2. In a He-Ne laser the two plane mirrors forming resonant cavity are at a distance of 0.5 m. What is the mode separation of longitudinal cavity in terms of frequency ?
3. What is mode locking in Lasers ? Describe how mode locking is done.
4. A step index multimode fiber has core index of 1.5 and cladding index of 1.498. Calculate
 - a) The intermodal factor for the cable
 - b) Total dispersion in an 18 km length
 - c) Maximum bitrate allowed.
5. Find the ratio of populations of the two states in a He-Ne laser that produces light of wavelength 6320Å at 27 degrees.
6. Describe the working of a solid state ruby laser.
7. What are hot bands ? Why are they called so ?
8. Explain the various mechanisms of attenuation losses in optical fibres.
9. Explain the different spectroscopies associated with the different regions of the electromagnetic spectrum bringing out the nature of transitions involved.
10. Explain the advantages of using laser as a Raman source.
11. Explain holographic interferometry.
12. Explain the effect of isotopic substitution in rotational spectra. (9×2=18)

PART – D

Answer **any one** question. **Each** question carries **4 W**.

1. What is holography ? Describe the principle and the process of recording and reconstruction of a hologram.
2. Describe an experimental arrangement to study Raman effect. How is Raman scattering different from Compton's scattering ? (1×4=4)