



Reg. No. :

Name :

VI Semester B.Sc. Degree (CCSS-Reg./Sup./Imp.) Examination, May 2015
 CORE COURSE IN PHYSICS
 6B12 PHY : Photonics and Spectroscopy
 (2012 Admn.)

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) Laser light is
 - a) Coherent
 - b) Non coherent
 - c) Divergent
 - d) Unco-ordinated source
- iii) Dye lasers are also called
 - a) Solid state lasers
 - b) Tunable lasers
 - c) Fusion lasers
 - d) Switched lasers
- iv) An optical fiber has a bandwidth of
 - a) One kHz-km
 - b) One MHz-km
 - c) Less than one GHz-1 km
 - d) Grater than one THz-km
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
- ii) The spontaneous emission is predominant in the
 - a) Infrared region
 - b) Far infrared region
 - c) Visible infrared region
 - d) All these



- 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) Raman scattering light is
- | | |
|-------------------------|---------------------------|
| a) Circularly polarized | b) Elliptically polarized |
| c) Plane polarized | d) Unpolarised |

(2×1=2)

PART – B

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

1. What are Einstein's coefficients ?
2. What is population inversion ? Why is it necessary for lasing action ?
3. What is an optical resonator cavity ? What is its role in a laser ?
4. In a He-Ne laser an increase in diameter of the laser may reduce lasing efficiency. Why ?
5. What is an optical fiber ?
6. Explain the causes of attenuation and distortion of light through the optical fiber.
7. What is attenuation of a light signal ? Give the units of attenuation.
8. Explain core and cladding losses.

(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. What is quality factor ? Derive an expression for the quality factor.



3. What is mode locking in lasers ? Describe how mode locking is done.
4. Calculate the maximum dispersion for an optically graded fiber of length 1 km, $\Delta=0.026$ and refractive index core = 1.5.
5. Find the ratio of populations of the two states in a He-Ne laser that produces light of wavelength 6320 Au at 27 degrees.
6. Explain the terms Doppler broadening and line broadening.
7. Explain the various mechanisms of attenuation losses in optical fibres.
8. What are hot bands ? Why are they called so ?
9. Explain the advantages of using laser as a Raman source.
10. Explain the working of a fibre optic sensor ? Give its application.
11. Explain the effect of isotopic substitution in rotational spectra.
12. Distinguish between passive and active optical fiber sensors.

(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. Discuss :
 - a) Bending losses
 - b) Intrinsic fiber losses
 - c) Scattering losses in an optical fiber.

(1×4=4)