



DEPARTMENT OF PHYSICS

"T3, Examination, May 2018"

Semester: II

Subject: Optics and Optical Devices

Branch: CSE/IT/ECE

Course Type: Core

Time: 3 Hours

Max.Marks: 80

Date of Exam: 24/05/2018

Subject Code: PHH 105 -T

Session: Morning

Course Nature: Hard

Program: B.Tech

Signature: HOD/Associate HOD

Note: All questions are compulsory from part A ($2 \times 10 = 20$ marks). Attempt any two questions from Part B and two questions from Part C.

Part A

Q.1 Compulsory question: ($10 \times 2 = 20$)

- Define normalized frequency (V-Number) in single mode and multimode fiber.
- Define specific rotation of the substance. Determine the value of specific rotation if plane polarization is rotated by 20° for a sugar solution of concentration 15/100 gm/cc. The polarimeter tube length is 2 decimeter.
- What are the differences between intermodal and intramodal dispersion.
- Differentiate between spontaneous and stimulated emission.
- Determine the numerical aperture of a step index fiber when the core refractive index $n_1 = 1.5$ and cladding refractive index $n_2 = 1.48$.
- In a ruby laser total number of Cr^{3+} ions are 2.8×10^{19} . If the LASER emits radiation of $\lambda \sim 7000 \text{ \AA}$. Calculate the energy of LASER pulse.
- The optical power after propagation through a fiber that is 500m long is reduced to 25% of its original value. Calculate the fiber loss in dB/Km.
- What do you mean by polarization? What are the differences between polarized and unpolarized light.
- The coherence length of sodium light is $2.945 \times 10^{-2} \text{ m}$ and its wavelength is 5890 \AA . Calculate (i) the number of oscillations corresponding to coherence length and (ii) the coherence time.
- A half wave plate is constructed for a wavelength of 6000 \AA . For what wavelength does it work as a quarter wave plate?

Part B (Attempt any two questions) ($15 \times 2 = 30$)

Q.2 What is a Nicol prism? Explain construction, working and limitations of Nicol prism. Also explain the phenomenon of double refraction in uniaxial crystal.

- Q.3** Define Einstein coefficient of absorption, spontaneous emission and induced emission. Obtain relationship between them. Write four application of LASER.
- Q.4** Discuss the principle of LASER. What are the main components of LASER? Explain the construction and working of He-Ne laser.

Part C (Attempt any two questions) (15×2 = 30)

- Q.5** What is an optical fiber? Discuss the principle of light transmission in an optical fiber. Define the term angle of acceptance and numerical aperture and derive a relation between them.
- Q.6** Explain different types of fibers? Write three advantages and disadvantages of optical fiber. Write four application of optical fiber. Find the diameter of the core for single mode transmission at 8500 \AA whose refractive indices for core and cladding are 1.48 and 1.47 respectively.
- Q.7** Draw the block diagram of optical fiber communication system and explain the function of each block. Also explain different types of losses in fibers.