

Unit-1

(P-13)

Light as an Electromagnetic Wave: Plane waves in homogeneous media, concept of spherical waves, Reflection and transmission at an interface, total internal reflection, Brewster's Law. Interaction of electromagnetic waves with dielectrics: origin of refractive index, dispersion.

Interference : Superposition of waves of same frequency, Concept of coherence, Interference by division of wavefront, Young's double slit, Division of Amplitude, thin film interference, anti-reflecting films, Newton's rings; Michelson interferometer

Diffraction: Huygen Fresnel Principle, Diffraction Integral, Fresnel and Fraunhofer approximations. Fraunhofer Diffraction by a single slit, rectangular aperture, double slit, circular aperture; Resolving power of microscopes and telescopes; Diffraction grating

Unit-2

(P-11)

Polarization: Linear, circular and elliptical polarization, polarizer-analyzer and Malus' law; Double refraction by crystals, Interference of polarized light, Principle of Liquid Crystal Displays.

Wave propagation in crystals: Wave propagation in uniaxial media. Half wave and quarter wave plates. Faraday rotation and electrooptic effect.

Unit-3

(P-12)

LEDs : Light Emitting Diodes: principle, structure and materials. Lasers: Interaction of radiation and matter, Einstein coefficients, Condition for amplification, laser cavity, threshold for laser oscillation, line shape function. Examples of common lasers. The semiconductor injection laser diode. Holography. Photodetectors: Bolometer, Photomultiplier tubes, Charge Coupled Devices; Photodiodes (p-i-n, avalanche), quantum efficiency and responsivity.

Unit-4

(P-12)

Dielectric waveguide and Fiber: TE and TM modes in symmetric stub waveguides, effective index, field distributions, Dispersion relation, and group velocities. Step index optical fiber, total internal reflection, concept of linearly polarized waves in the step index circular dielectric waveguides, single mode and multimode fibers, attenuation and dispersion in optical fiber.

Essential Texts

UNIT 1

CHAPTERS 12, 13, 16, 17-AjoyGhatak, Optics, Tata McGraw Hill, New Delhi

(2005) UNIT 2

CHAPTER 19-AjoyGhatak, Optics, Tata McGraw Hill, New Delhi (2005)

UNIT 3

CHAPTER 4, 5, 7 Wilson and Hawkes, Optoelectronics; An Introduction(3rd ed.)

PHI. UNIT 4

CHAPTERS 8-Wilson and Hawkes, Optoelectronics; An Introduction(3rd ed.) PHI.

Suggested Books:

1. Wilson and Hawkes, Optoelectronics; An Introduction(3rd ed.) PHI.
2. E. Hecht, Optics, Pearson Education Ltd. (2002)
3. S. O. Kasap, Optoelectronics and Photonics: Principles and Practices, Pearson Education (2009)
4. Ghatak A.K. and Thyagarajan K., "Introduction to fiber optics," Cambridge Univ. Press. (1998)

Practicals - Photonics

1. To verify the law of Malus for plane polarized light.
2. To determine wavelength of sodium light using Michelson's Interferometer.
3. To determine wavelength of sodium light using Newton's Rings.
4. To determine the resolving power and Dispersive power of Diffraction Grating.
5. Diffraction experiments using a laser.
6. To determine the specific rotation of scan sugar using polarimeter.
7. Characteristics of LEDs and Photo- detector.
8. To measure the numerical aperture of an optical fiber.
9. Optical Fiber as a sensor.