Vidyavardhini's College of Engineering & Technology, Vasai (W)

First Year Engineering

Academic Year: 2024-25

Subject: BSC102/AP **QUESTION BANK - (IAT-I)**

Course Outcome (CO)-1: Laser

Theory Questions:

1. Explain the basic quantum processes in laser: A) Induced Absorption B) Spontaneous Emission C) Stimulated Emission
2. Explain: Active medium, resonating cavity, and pumping mechanism for laser.
3. Explain Helium-Neon Laser with energy level diagram.
4. Explain any one application of laser. a) Application of Laser in LiDAR b) Application of Laser in Barcode Reader c) Application of Laser in metal work

Numericals:

1. The ground state and excited state of the laser is separated by 1.8 eV. Calculate the ratio of the number of atoms in the excited state to the ground state and wavelength of the radiation emitted at room temperature. (**Ans**: 6.14×10^{-31})
2. If a laser source emits the optical power of 5 mW. Calculate the number of photons emitted per second from the source of wavelength 6000 A. (**Ans**: 1.5×10^{16})
3. Light of wavelength 4800 A has a length of 25 waves. What is coherence length and coherence time of the laser beam. (**Ans**: 12×10^{-6} m and 4.0×10^{-14} s)

Course Outcome (CO)-2: Fibre Optics

Theory Questions:

1. Explain: Numerical aperture, critical angle and, angle of acceptance.
2. Derive an expression for the acceptance angle in optical fibre.
3. Distinguish between Step Index and Graded Index Optical.
4. Explain the application of optical fibre in communication.

Numericals:

1. A light ray enters an optical fiber from the air. The fiber has a core refractive index of 1.52 and a cladding refractive index of 1.41. Find the Critical angle and numerical aperture. (**Ans**: 68.06^0, 0.26)
2. Calculate the number of modes of a step-index optical fiber of diameter 40 $\boldsymbol{\mu m}$ if its core and cladding refractive indices are 1.5 and 1.46, respectively. The wavelength of light used is 1.5 $\boldsymbol{\mu}$m. (**Ans**: 415)
3. Calculate the refractive indices of the core and cladding material of a fiber if the numerical aperture is 0.22 and the Fractional R.I change is 0.012. (**Ans**: $n_1 = 1.41$, $n_2 = 1.427$)
4. Optical power of 1 mW is launched into an optical fibre of length 100 m. The power emerging from the other end is 0.3 mW. Calculate the coefficient of attenuation. (**Ans**: 53.3 dB/km)

Course Outcome (CO)-3: Interference in thin Film

Theory Questions:

1. Differentiate the types of interference: Division of amplitude and Division of wave front
2. Derive an expression for the optical path difference in a thin film of uniform thickness.
3. Derive the expression for the fringe width in wedge-shaped thin film.

Numericals:

1. A wedge shaped air film having an angle of 40 seconds is illuminated by monochromatic light and fringes are observed vertically through a microscope. The distance measured between two consecutive bright fringes is 0.12 cm. Calculate the wavelength of light used.
2. Find the minimum thickness of soap film, which appear yellow (Wavelength 5896Å) in reflection when it is illuminated by white light at an angle of 45^0.Given, refractive index of the film is 1.33.

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