

(Following Paper ID and Roll No. to be filled in your Answer Book)

PAPER ID : 2519

Roll No.

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B.Tech.

(SEM. VI) THEORY EXAMINATION 2011-12

OPTO ELECTRONICS

Time : 2 Hours

Total Marks : 50

Note :— (1) All questions carry equal marks.

(2) Attempt **all** questions.

1. Attempt any **four** of the following :— **(3½×4=14)**
- (a) When a LED has 2 V applied to its terminals, it draws 100 mA current and produces 2 mW of optical power. What is the LED's conversion efficiency from electrical to optical power ?
- (b) Explain about the wave nature of Light.
- (c) Calculate the velocity of light in the optically active region of a substance at 850 nm and at 1300 nm. Also compute the corresponding wavelengths. Given that Refractive index of the substance at 850 nm is 3.6 and at 1300 nm is 3.4. Velocity of light in free space $c = 3 \times 10^8$ m/s.
- (d) Explain in detail the characteristics of photo detectors.

- (e) List different modes of LASER and explain them in detail.
- (f) Draw comparison table between step index fibers and graded index fibers.
2. Attempt any **two** of the following :— **(6×2=12)**
- (a) What is Birefringence phenomenon ? Name two materials in which it is naturally present. Demonstrate it with the help of diagram taking suitable example.
- (b) Explain the construction and working of optical isolator based on the Faraday's Effect. Discuss the importance of Parametric Amplification.
- (c) Explain Acousto-optic effect. Calculate the Bragg angle, the maximum change in refractive index of the material and maximum width of the optical beam of wavelength 633 nm that may be modulated with a bandwidth of 5 MHz. If the modulator length is 50 mm, diffraction efficiency is 70%, while the acoustic wavelength is 4.3×10^{-5} m and the acoustic velocity is 3500 m/s.
3. Attempt any **two** of the following :— **(6×2=12)**
- (a) Explain the working of Michelson Interferometers with the help of diagram. Discuss phase transforming property of thin lenses.
- (b) Describe the principle of Holography and deduce the mathematical analysis of Holography. Categorise different type of Holographic Interferometers and explain them.

(c) How optical lenses are used in designing optical Adder and Multiplier considering two dimensional input images.

4. Attempt any **two** of the following :— **(6×2=12)**

(a) State the principle on which fiber optics gyroscope works. Derive the expression for phase shift and list the factors that do not affect the phase shift.

(b) Explain with relevant figure the working of current sensor and pressure sensor using optical fiber.

(c) Specify the role of Spatial Light Modulator. Explain the construction of electronically addressed SLM.

(d) Perform the following digital arithmetic operations :

(i) $(27)_{10} + (15)_{10}$ using MSD arithmetic

(ii) $21 + 13$ and $46-21$ using residue arithmetic and bases are 3, 5 and 7.