Roll No.										

Paper Code: IC-021

B.Tech.
(SEM VI) EVEN SEMESTER EXAMINATION, 2015-16
OPTO ELECTRONICS

[Time: 2 hrs.] **[Max. Marks: 50]**

Note:- (i) All Question carry equal marks.
(ii) Attempt all questions.

1. Attempt any four of the following: - **[3x4=12]**

(a) Consider dielectric slab and prove that the effective amplitude of the electric field at any height y from the center guide is represented as $2E_0\cos\{(m\pi/2 - (y/d)(m\pi+\phi)\}$.
(b) Find the propagation angles, the effective refractive indices, if the number of TE modes in an AlGaAs wave guide is 3 and 4 for $d/\lambda = 2$ and 3 respectively. Consider symmetric wave guide slab having $n_1=3.6, n_2= 3.55$ free space propagation wavelength $\lambda = 0.82\mu m$.
(c) A graded index fiber with a parabolic reflector index profile core has a refractive index at the core axis of 1.5 and relative index difference of 1%.Estimate the maximum possible core diameter which allows single mode operation at the wave length of 1.3 μm.
(d) Derive LASER diode Rate equations and calculate the number of photons per unit volume under steady state condition.
(e) Discuss any two optical wave confining and one current confining lased diode structures.
(f) With suitable diagram discuss Surface emitting LEDs. Also explain modulation response of LED.

2. Attempt any two of the following: - **[7x2=14]**

(a) What is Birefringence phenomenon? Name two materials in which it is naturally present? With suitable diagram discuss longitudinal electro-optic modulator made of KDP crystal.
(b) 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 50mm , diffraction efficiency is 70%, while the acoustic wavelength is 4.3×10^{-5} m and the acoustic velocity is 3500 m/s.
(c) What is electro optic effect? How we can produce circularly polarized light? Calculate the thickness of a quarter wave plate made of calcite and to be used with sodium light (λ 589.3)It is given that the principal refractive indices n_0 and n_e for calcite are 1.658 and 1.486,respectively.

3. Attempt any two of the following: - **[6x2=12]**

(a) Classify Fiber optic Sensors. With suitable diagram explain the working of any two type of Intensity modulated sensors.
(b) Explain with relevant figure the working of displacement, current sensor and pressure sensor using optical fiber.
(c) Explain Micro and Macro bending in optical fiber. Explain with suitable block diagram the working of intrinsic type of micro-bend sensor.

4. Attempt any four of the following: - **[3x4=12]**

(a) Discuss the importance of lens in optical computing. Explain the working of optical Adder and Multiplier considering two dimensional input images.
(b) Explain working and operating principle spatial filters. What is Half tone Image? Write down its importance in image processing
(c) Discuss the salient features of residue number system. Add 25 and 13 in residue no system 3, 5, 7.
(d) Specify the role of Spatial Light Modulator. Explain the construction of optically addressed SLM.
(e) Perform the following digital arithmetic operations:
(i) $(27)_{10} + (15)_{10}$ using MSD arithmetic. (ii) $(13)_{10} - (2)_{10}$ using MSD arithmetic.
(f) What is threshold logic? Explain its importance with suitable diagram