Printed Pages—4 **EEC701**

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

PAPER ID : 2726 **Roll No.** | | | | | | | | | | |

B.Tech.

(SEM. VII) ODD SEMESTER THEORY EXAMINATION 2012-13

OPTICAL COMMUNICATION

Time : 3 Hours *Total Marks : 100*

Note :— *(1) All questions are compulsory.*

(2) All questions carry equal marks.

1. Attempt any **FOUR** parts of the following :— **(5×4=20)**

(a) Sketch the block diagram of optical fiber communication system.

(b) List out various advantages of optical fiber communication system over the conventional electrical communication system.

(c) Explain the concept of acceptance angle in optical fiber with the help of proper diagram. How it is related to the numerical aperture of optical fiber ?

(d) With the suitable ray diagram, explain the propagation of skew rays in the optical waveguide and compare it with Mendional ray.

(e) A graded index fiber has a core with a parabolic refractive index profile which has a diameter of 50 μm. The fiber has a numerical aperture of 0.2. Estimate the total number of guided modes propagating in the fiber when it is operating at a wavelength of 1 μm.

(f) Mention any two materials system used in the fabrication of optical fibers. Explain the Vapor-phase deposition techniques to produce silica rich glasses of highest transparency.

2. Attempt any **TWO** parts of the following : **10×2=20**

(a) With the aid of suitable diagram, briefly discuss the following in the case optical fiber transmission :

(i) Fiber bend losses;

(ii) Dispersion shifted fibers.

(b) Describe the mechanism of intermodal dispersion in a multimode step index fiber. Show that the total broadening of a light pulse ΔT_S due to intermodal dispersion in a multimode step index fiber may be given by :

$$\Delta T_S = \frac{L(NA)^2}{2n_1 c}$$

where L is the length of the fiber, NA is the numerical aperture of the fiber, n_1 is the core refractive index and c is the velocity of light in vacuum.

(c) Explain what is meant by :

(i) Modal birefringence

(ii) The beat length in single mode fibers.

The difference between the propagation constants for the two orthogonal modes in a single mode fiber is 250. It is illuminated with light of peak wavelength 1.55 μm from an injection laser source with a spectral line width of 0.8 nm. Estimate the coherence length within the fiber.

3. Attempt any **TWO** parts of the following : **(10×2=20)**

(a) Explain the principle, construction and working of Semiconductor Injection laser.

(b) The radiative and non-radiative recombination lifetimes of the minority carriers in the active region of double heterostructure LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA.

(c) Explain the working principle of LED. How the quantum efficiency of a LED is defined ? List out various parameters which are needed to be optimized for getting maximum output power from the LED.

4. Attempt any **FOUR** parts of the following : **(5×4=20)**

(a) Derive an expression for the coupling efficiency of a surface emitting LED into a step index fiber, assuming the device to have a Lambertian output.

(b) A p-i-n photodiode on average generate one electron-hole pair per three incident photons at a wavelength of 0.8 μm. Assuming all the electrons are collected, calculate :

(i) the quantum efficiency of the device

(ii) the maximum possible bandgap energy.

(c) Explain the principle, construction and working of APD.

(d) Briefly discuss the possible sources of noise in optical fiber receivers. Describe the quantum noise in detail.

(e) Sketch the full equivalent circuit for a digital optical fiber receiver. Briefly explain its various parts.

(f) Explain the detection process in p-n photodiode. Compare this device with the p-i-n photodiode.

5. Write short notes on any **TWO** of the following :

(10×2=20)

(a) The Optical Power Meter

(b) OTDR

(c) Wavelength Division Multiplexing.