

Code: EC7T1

IV B.Tech - I Semester – Regular Examinations – October - 2017

**OPTICAL COMMUNICATIONS
(ELECTRONICS & COMMUNICATION ENGINEERING)**

Duration: 3 hours

Max. Marks: 70

PART – A

Answer *all* the questions. All questions carry equal marks

11 x 2 = 22

1.

- a) Write the expression for the refractive index in graded index fibers.
- b) Why indirect band gap material is used for manufacturing LED's?
- c) What is the responsivity of a photodiode if its quantum efficiency is 90%.
- d) Give example for direct and indirect semiconductor materials.
- e) Calculate the ratio of stimulated emission rate to the spontaneous emission rate for a lamp operating at a temperature of 100 K . Assume average operating wavelength is 0.5 micro meter.
- f) List the key requirements needed in analyzing a link.
- g) What is the carrier frequency for an optical communication system operating at 1.55 μm .

- h) Give expression for the effective number of modes guided by a curved multimode fiber.
- i) What is the role of system margin in link power budget?
- j) Define cutoff wavelength of the fiber.
- k) What are the causes of intra modal dispersion?

PART – B

Answer any **THREE** questions. All questions carry equal marks.

$$3 \times 16 = 48 \text{ M}$$

- 2. a) Why we need optical fiber cables? Explain various types of fiber optic cables used in the industry. 8 M

- b) A 6km optical link consists of multimode step index fiber with a core refractive index of 1.5 and a relative refractive index difference of 1%. Estimate the delay difference between the slowest and fastest mode at fiber output and rms pulse broadening due to inter-modal dispersion on the link. 8 M

- 3. a) Define and distinguish between the different types of signal distortion in optical fibers. 8 M

- b) A long single-mode optical fiber has an attenuation of 0.5 dB km^{-1} when operating at a wavelength of $1.3 \mu\text{m}$. The fiber core diameter is $6 \mu\text{m}$ and the laser source bandwidth is 600 MHz. Compare the threshold optical powers for

- stimulated Brillouin and Raman scattering within the fiber at the wavelength specified. 8 M
4. a) With neat diagram explain the construction and working of high radiance surface emitting LED. 8 M
- b) Explain the working principle of Semi Conductor Injection Laser with neat diagram. 8 M
5. a) Draw structure of Avalanche photo diode and describe its working as optical detector. 8 M
- b) Draw structure and explain semi-conductor photo diode with-out internal gain. 8 M
6. a) What is WDM and list the reasons for its development as a major Communication technology. 8 M
- b) Describe the function of each SONET layer with the help of diagram. 8 M