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B.Tech.(ECE) (2012 to 2017) (Sem.-7,8)

OPTICAL COMMUNICATION

Subject Code : BTEC-702

M.Code : 71911

Time : 3 Hrs.

Max. Marks : 60

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

Q1) Write briefly :

- a) What are the kinds of modulation formats used in optical communications?
- b) A certain fiber has an attenuation loss of 1.5 dB/km at 1300 nm. If 0.5 mW of optical power is initially launched into the fiber, what is the power level in microwatts after 8 km?
- c) Define Bitrate (BR) and Bit Error Rate (BER).
- d) Explain the concept of cavity in the lasers.
- e) What are the possible principal requirements in optical connectors? List them.
- f) Distinguish between line width and bandwidth.
- g) Give the sources of noise in optical receivers.
- h) Calculate Line width (Frequency Spread) of two Fabry-Perot lasers operating on :
 - i) Wavelength 1300 nm at 3 nm spectral width
 - ii) Wavelength 1550 nm at 4 nm spectral width.
- i) How are LED structures different from their counterpart LASERs?
- j) Draw Speckle / Model noise pattern that is produced when coherent laser light is launched into multimode fiber.

SECTION-B

- Q2) Establish the necessary threshold condition for Laser diode. Discuss Injection laser characteristics, Mode Hopping, Frequency chirp.
- Q3) Write and apply Maxwell equations for optical fiber communication. Derive the standard wave equation using them.
- Q4) Explain the design and working principle of APD. What are its advantages and disadvantages? Discuss compromises to improve its performances.
- Q5) Estimate the CW operating lifetime for an AlGaAs LED with an activation energy of 0.6 eV and a constant of proportionality (β_0) of $2.3 \times 10^3 \text{ h}^{-1}$ when the junction temperature of device is constant at 50°C. It may be assumed that the LED is no longer useful when its optical power is 0.8 of its value.
- Q6) Discuss in short Linear and Stimulated Scattering, Frequency chirping.

SECTION-C

- Q7) How does light propagate through optical fibers? What is its basic principle? Establish the condition for light ray transmission through a step indexed fiber on the basis of ray theory. Distinguish the fibers types on the basis of light propagation and bandwidth : SI-MMF, GI-MMF, and SMF.
- Q8) Explain in detail the multiplexing technique: WDM, OTDM, Subscriber Multiplexing and Code Division Multiplexing used in optical communication.
- Q9) a) Write short note on : DFB lasers, Responsivity.
- b) A multimode step index fiber is operating at a wavelength of 0.85 μm with a core diameter of 80 μm and a relative index difference 1.5%. If the refractive index of core is 1.48. Determine :
- i) Normalized frequency for the fiber.
- ii) The number of guided modes.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.