



B.E DEGREE EXAMINATIONS: APRIL / MAY 2023

(Regulation 2018)

Seventh Semester

ELECTRONICS AND COMMUNICATION ENGINEERING

U18ECI7203: Optical Communication

COURSE OUTCOMES

- CO1:** Discuss optical fiber communication link structure, characteristics of fiber and fabrication techniques.
CO2: Measure and analyze the propagation characteristics of an optical signal in different types of Fibers.
CO3: Analyze the characteristics of different optical sources.
CO4: Inspect the optical receivers and amplifiers of an optical transmission system.
CO5: Analyze optical fiber transmission system.
CO6: Outline basic optical network concepts and components involved.

Time: Three Hours

Maximum Marks: 100

Answer all the Questions:-

PART A (10 x 2 = 20 Marks)

(Answer not more than 40 words)

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|--|-----|-------------------|
| 1. Consider a multimode silica fiber with core index as 1.50 and cladding index as 1.47. Inspect for Total Internal Reflection of the launched optical signal, if the optical signal is incident on the core-cladding interface at an angle of 83 degrees. | CO1 | [K ₃] |
| 2. Compare meridional rays and skew rays. | CO1 | [K ₂] |
| 3. Justify how dispersion degrades the optical signal. | CO2 | [K ₂] |
| 4. Outline any two potential applications of Special fiber. | CO2 | [K ₂] |
| 5. Summarize the differences between LED and LASER optical source. | CO3 | [K ₂] |
| 6. Contrast the differences between Direct Band Gap (DBG) and Indirect Band Gap (IBG) semiconductors. | CO3 | [K ₂] |
| 7. Determine the Quantum efficiency of the photodiode at 1300 nm when 6×10^6 photons with 1300 nm wavelength incident on photodiode, on average 5.4×10^6 electron-hole pairs are generated at the terminals of the device? | CO4 | [K ₃] |
| 8. Recall quantum limit | CO4 | [K ₁] |
| 9. List the key system requirements in analyzing a point-to-point link. | CO5 | [K ₁] |
| 10. Interpret the need for layered optical network architecture | CO6 | [K ₂] |

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

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|-----|----|--|----|-----|-------------------|
| 11. | a) | Summarize the major advantages of an optical fiber communication system and explain the key components of an Optical Fiber Transmission link with a neat schematic. | 10 | CO1 | [K ₃] |
| | b) | Discuss the operation of an optical isolator with a neat sketch. | 6 | CO1 | [K ₃] |
| 12. | | Inspect the importance of signal attenuation in the design of an optical communication system. Elaborate on three basic attenuation mechanisms that degrade the optical signals as they propagate in a fiber. | 16 | CO2 | [K ₃] |
| 13. | a) | Justify the need for Double Hetero (DH) structure and discuss how DH structure is achieved in SLED and ELED. | 12 | CO3 | [K ₂] |
| | b) | A double-heterojunction InGaAsP LED emitting at a peak wavelength of 1310 nm has radiative and non-radiative recombination times of 30 and 100 ns respectively. The drive current is 40 mA. Determine Bulk recombination lifetime and Internal quantum efficiency. | 4 | CO3 | [K ₃] |
| 14. | a) | Explain the structure and operation of the reach-through Avalanche Photodiode with neat diagrams. | 8 | CO4 | [K ₂] |
| | b) | Discuss the principle of operation of an Erbium-doped fiber amplifier with energy band diagrams | 8 | CO4 | [K ₂] |
| 15. | | Examine how link power budget and rise time budget are done for an optical link with appropriate models. Make use of numerical examples to illustrate the same. | 16 | CO5 | [K ₃] |
| 16. | a) | Analyze how polarization affects the signal propagation in an optical waveguide and causes dispersion. | 6 | CO2 | [K ₃] |
| | b) | Elaborate on SONET/SDH optical standard with frame format and architecture | 10 | CO6 | [K ₂] |
