

Code: AE75 Subject: OPTOELECTRONICS AND COMMUNICATION

**AMIETE – ET (Current Scheme)**

Time: 3 Hours

**June 2019**

Max. Marks: 100

*PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.*

**NOTE:** There are 9 Questions in all.

- Question 1 is compulsory and carries 20 marks. Answer to Q.1 must be written in the space provided for it in the answer book supplied and nowhere else.
- The answer sheet for the Q.1 will be collected by the invigilator after 45 minutes of the commencement of the examination.
- Out of the remaining EIGHT Questions answer any FIVE Questions. Each question carries 16 marks.
- Any required data not explicitly given, may be suitably assumed and stated.

**Q.1 Choose the correct or the best alternative in the following: (2×10)**

- The critical angle of incidence is the
  - The angle of incidence that causes the refracted light to travel along the interface between the two different mediums.
  - Minimum angle of incidence at which the ray strikes the interface of 2 media and causes an angle of refraction equal to 90°.
  - Both (A) & (B)
  - None of these
- Snell's law relates to
  - Light reflection
  - Light refraction
  - Light transmission
  - Light Absorption
- The bandwidth and distance capability of optical fiber means that
  - Fewer cables are needed
  - Fewer repeaters are needed
  - Less power is consumed by the network
  - Less maintenance is required
- The advantages of optical fibers compared to copper wires includes
  - Long distance transmission
  - Increased signal security
  - Both (A) & (B)
  - None of these
- Dispersion is used to describe the
  - Splitting of white light into its component colors
  - Propagation of light in straight lines
  - Bending of a beam of light when it goes from one medium to another
  - Bending of a beam of light when it strikes a mirror
- The necessity of cladding for an optical fiber
  - To provide mechanical strength for the fiber
  - To protect the core from scratches and other mechanical damages.
  - To avoid leakage of light from the fiber.
  - All of these

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- g. The core of an optical fiber has a  
 (A) Lower refracted index than air  
 (B) Lower refracted index than the cladding  
 (C) Higher Refractive index than the cladding  
 (D) Similar refractive index with the cladding
- h. SONET/SDH is a synchronous network using synchronous  
 (A) TDM multiplexing (B) CDMA multiplexing  
 (C) TDM duplexing (D) CDMA duplexing
- i. What technological progress has allowed the full usage of fiber optics within parallel computer architecture?  
 (i) There are compilers and programming that recognizes and exploits parallelism.  
 (ii) Widely tunable semiconductor lasers allow multiple wavelength system.  
 (iii) Newly designed operating system for parallel processing.  
 (iv) Migration of architectural features previously found on mainframes onto single-chip microprocessors.  
 (A) (i) and (iii) only (B) (ii), (iii) and (iv) only  
 (C) (i), (ii) and (iv) only (D) (i), (ii), (iii) only
- j. What makes optical fibers immune to EMI?  
 (A) They transmit signals in as light rather than electric current.  
 (B) They are too small for magnetic fields to introduce current in them.  
 (C) Magnetic fields cannot penetrate the glass of the fiber.  
 (D) They are readily shielded by outer conductors in cable.

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**Answer any FIVE Questions out of EIGHT Questions.**  
**Each question carries 16 marks.**

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- Q.2** a. Explain the structure of single mode and multimode step index and graded-index optical fibers with cross section and ray path. (8)
- b. What are requirements of fiber material? Explain glass fiber (8)
- Q.3** a. Compare Macro-bending and Micro-bending losses and briefly explain Mode coupling with a neat diagram. (8)
- b. Drive an expression for pulse spreading and dispersion, which is a function of wavelength using time delay. (8)
- Q.4** a. Explain with a neat diagram of typical GaAlAs double hetero structure LED, along with energy band diagram and refractive index profile and also briefly explain principles of photo detectors. (8)
- b. Derive the quantum efficiency and power emitted by the LED and also explain External quantum efficiency with the help of equations. (8)

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- Q.5** a. Explain any five design requirements of a good optical fiber connector and highlight sensing schemes used during connection. (8)
- b. Explain briefly the two different types of splicing techniques with the help of diagrams. (8)
- Q.6** a. Discuss with a neat diagram how digital signal transmission takes place in a fiber transmission link. (8)
- b. What are the noise sources and disturbances that arise in optical pulse detection mechanism? Describe the digital receiver performance parameters. (8)
- Q.7** a. Draw the block diagram of basic elements of an analog link and explain. (8)
- b. Explain multichannel A.M technique employed in broadband analog applications. What is RF-over-fiber technique? Explain. (8)
- Q.8** a. What is rise time budget analysis? Derive an expression for the total system rise time budget in terms of transmitter fiber and receiver rise time. (8)
- b. Explain with neat diagram the fundamental concept of coherent detection. (8)
- Q.9** a. Define WDM. With the help of schematic explain the operational principle of WDM. (8)
- b. Explain briefly the following (8)
- (i) Semiconductor amplifiers with diagrams.
- (ii) SDH/SONET with frame structure.