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**M.Sc. (Fourth Semester)  
EXAMINATION, May-June, 2022  
ELECTRONICS  
Paper - II (EL - 402)  
Optical and Satellite Communication**

*Time : Three Hours]**[Maximum Marks:80***Note: Attempt all sections as directed.**

**Section - A  
(Objective/Multiple Type Questions)**

**(1 mark each)****Note: Attempt all questions.****Choose the correct answer.**

- The light is propagated within the fiber core by the phenomenon
  - total internal reflection at core-cladding intersection
  - refraction at core-cladding intersection
  - total internal reflection at the outer surface of the cladding
  - change in the velocity of light within the fiber core

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- In \_\_\_\_\_ profile optical fibers, the propagation of light rays is almost horizontal provided the low-refractive index fiber core has relatively smaller diameter as compared with those of other types of optical fibers.
  - multimode step-index
  - multimode graded-index
  - multimode single-index
  - single-mode
- Dispersion is maximum in \_\_\_\_\_ type of optical fibers.
  - Multimode step-index
  - Multimode graded-index
  - Multimode single-index
  - Single-mode
- Which photo detectors available for fiber optic links has fastest response time?
  - P-N diode
  - LDR
  - Phototransistor
  - PIN diode
- A step-index fiber has specified parameters for refractive index of fiber core and cladding as 1.50 and 1.46 respectively. Its numerical aperture is:
  - 0.344
  - 0.156
  - 0.486
  - 0.244

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6. Which one of the following types does not exist in optical fibers?
  - (A) Single-mode step-index
  - (B) Single-mode graded index
  - (C) Multimode step - index
  - (D) Multimode graded - index
7. Fibre optic systems use what two types of optical sources
  - (A) LEDs and APDs
  - (B) PIN diodes and LEDs
  - (C) LEDs and Laser diodes
  - (D) Laser diodes and APDs
8. What fiber mechanisms weaken and distort the optical signal launched into the fiber?
  - (A) Scattering, absorption and dispersion
  - (B) Scattering, radiation and dispersion
  - (C) Dispersion, radiation and absorption
  - (D) Scattering reflection and refraction
9. The fiber NA relates to which of the following characteristics?
  - (A) Physical size of the fiber
  - (B) Tensile strength of the fiber
  - (C) Maximum angle within the fiber acceptance cone
  - (D) Speed of light within the fiber
10. What are the three basic parts of an optical fiber?
  - (A) Core, cladding and coating
  - (B) Inside, middle and outside
  - (C) Fiber, Kevlar and jacket
  - (D) Hole, Shell and coating

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11. A radius of curvature is larger than the fiber diameter in which of the following types of fiber bends?
  - (A) Macrobends
  - (B) Microbends
  - (C) Gentle bends
  - (D) Serpentine bends
12. Which type of scattering loss is proportional to the reciprocal of the fourth power of the wavelength of the light?
  - (A) Mie
  - (B) Raman
  - (C) Rayleigh
  - (D) Brillouin
13. The loss of optical power as light travels along a fiber is called
  - (A) Attenuation
  - (B) Scattering
  - (C) Absorption
  - (D) Dispersion
14. Fiber optic communication systems typically operate in what three wavelength windows?
  - (A) 400 nm, 850 nm, and 1550 nm
  - (B) 400 nm, 900 nm, and 1550 nm
  - (C) 850 nm, 1300 nm, and 1550 nm
  - (D) 1300 nm, 2000 nm, and 4000 nm

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15. A PIN photodiode usually operates in what ways?
- (A) Reverse bias voltage applied
  - (B) Forward bias voltage applied
  - (C) Both reverse bias voltage and Forward bias voltage applied
  - (D) No bias voltage applied
16. \_\_\_\_ system achieves and maintains the required attitudes, including main function maintaining accurate satellite position throughout the life span of the system.
- (A) Automatic control system
  - (B) Manual control system
  - (C) Attitude control system
  - (D) None of these
17. The carrier to noise ratio for a satellite depends upon
- (A) Effective isotropic Radiated power
  - (B) Bandwidth
  - (C) Free space path losses
  - (D) All of them
18. The optimum working frequency for satellite systems lies between
- (A) 10 GHz and 20 GHz
  - (B) 12 GHz and 30 GHz
  - (C) 50 GHz and 100 GHz
  - (D) 2 GHz and 12 GHz

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19. What is meant by transponder?
- (A) In a communication satellite, the equipment which provides the connecting link between the satellite's transmit & receive antennas is referred to as the transponder.
  - (B) In a communication satellite, the equipment which provides the power supply is referred to as the transponder.
  - (C) Both (A) & (B)
  - (D) None of above
20. What is an EIRP?
- (A) It is a measure of radiated or transmitted power of an antenna. It can be completed from the antenna gain & the power fed to the antenna input.
  - (B) It is a measure of radiated or transmitted power of an antenna. It can be completed from the antenna gain & the power fed from the antenna output
  - (C) Either (A) or (B)
  - (D) None of above

### Section - B

#### (Very Short Answer Type Questions)

(2 marks each)

**Note: Attempt all questions. The answer should be in 2 - 3 sentences**

1. Compare and contrast between pin photodiode with APD
2. Determine the optical power in dBm and dBu for power levels of 10 mW and 20  $\mu$ W.
3. What do you mean by Acceptance Angle of an optical fiber?

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4. What is meant by spot beam antenna?
5. What is meant by frequency reuse?
6. Why pulse broadening occurs in optical fibers?
7. What do you understand by single mode in optical fibers?
8. What is meant by transponder?

### Section - C

#### (Short Answer Type Questions)

(3 marks each)

**Note: Attempt any eight questions, (each carry 3 marks)  
8 x 3 = 24. The answer should be in <= 75 words.**

1. Compare Homo junction LEDs with Heterojunction LEDs for optical communication.
2. What is difference between step index fiber and graded index fiber?
3. Contrast the advantages and disadvantages of ILDs and LEDs.
4. Explain the LED emission pattern for edge emitting LED.
5. Explain losses caused by linear and nonlinear scattering in optical fiber.
6. Describe linear scattering losses in optical fibers.
7. Distinguish between Rayleigh scattering and Mie scattering
8. Explain intermodal and interamodal dispersion in graded index fiber.

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9. Describe about different types of atmospheric losses in satellite link.
10. What do you understand by splicing?

### Section - D

#### (Long Answer Type Questions)

(4 marks each)

**Note: Any five questions, each carry 4 marks. The answer should be in <= 150 words**

1. Explain Kepler's laws of planetary rotation.
2. Describe principle of working of APD.
3. Explain the advantages and disadvantages of optical communication.
4. Explain briefly the elements of a Satellite Communication System.
5. Describe the Optical fiber system link budget.
6. Describe the working of surface emitting LED.
7. Describe briefly double crucible method of manufacturing optical fiber.
8. Explain the experimental setup used for measurement of the signal attenuation in an optical fiber.
9. Write a short note on fabrication process of optical fiber.

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