B.Sc. ELECTRONICS
Fifth Semester (Repeat)
PHOTONICS & OPTOELECTRONICS DEVICES
(BSE - 23)

Duration: 3Hrs. **Full Marks: 70**

Part-A (Objective) =20
Part-B (Descriptive) =50

(PART-B: Descriptive)

Duration: 2 hrs. 40 mins. **Marks: 50**

Answer any *four* from *Question no.* 2 to 8
***Question no.* 1 is compulsory.**

1. What are the different modes exist in laser operation? Give a comparison in between them. (5+5=10)
2. What is a photodiode? Compare the different modes of operation. (2+8=10)
3. What are the various losses associated with an optical fiber cable? (10)
4. Explain the working principle of an optical amplifier. (10)
5. What is a polarizer? Explain the working principle of Pockel's cell. (3+7=10)
6. What do you mean by attenuation of a signal propagating along a fiber optic cable? An optical fiber of length 300 m is connected between a transmitter and a receiver, if the input power at the transmitting side is P_i, and the received power at the receiving side is P_o, then write down the equation for attenuation in dB. (5+5=10)
7. What do you mean by photoelectric effect? Discuss the various similarities and dissimilarities between electroluminescence and photoluminescence. (3+7=10)
8. Write short notes (*any two*): (5×2=10)
   a. Liquid crystals
   b. Mode locking
   c. Chromatic aberration

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Duration: 20 minutes **Marks – 20**

(PART A - Objective Type)

I. Choose the correct answer: **1×20=20**

1. What is the photon energy for an infrared wave with frequency of 1012 Hz?
   a. 10.6 x 1034 joules b. 6.63 x 10-34 joules
   c. 6.63 x 10-22 joules d. 10.6 x 1022 joules

2. Which of the following factor does not harm laser efficiency?
   a. Atmospheric absorption.
   b. Excitation energy not absorbed.
   c. Problems in depopulating the lower laser level.
   d. Inefficiency in populating the upper laser level.

3. The numerical aperture of a fiber if the angle of acceptance is 15 degrees, is
   a. 0.17 b. 0.26 c. 0.50 d. 0.75

4. The term critical angle describes
   a. the point at which light is refracted.
   b. the point at which light becomes invisible.
   c. the point at which light has gone from the refractive mode to the reflective mode.
   d. the point at which light has crossed the boundary layers from one index to another.

5. Fiber optic cables operate at frequencies near
   a. 20 MHz b. 200 MHz c. 2G Hz d. 800 THz

6. When a beam of light enters one medium from another, which quantity will not change?
   a. Direction b. Speed
   c. Frequency d. Wavelength

7. Dispersion is used to describe the

   a. Splitting of white light into its component colors.

   b. Propagation of light in straight lines.

   c. Bending of a beam of light when it goes from one medium to another.

   d. Bending of a beam light when it strikes a mirror.

8. The wavelength of light has no role in

   a. Diffraction b. Interference

   c. Polarization d. Reflection

9. _____is caused by the difference in the propagation times of light rays that take different paths down a fiber.

   a. Material dispersion b. Wavelength dispersion

   c. Modal dispersion d. Delay dispersion

10. Photodiodes used as fiber optic detectors are

   a. Unbiased to generate a voltage same as a solar cell.

   b. Forward bias.

   c. Reversed bias.

   d. Thermoelectrically cooled.

11. Which type of laser is the simplest to modulate directly by changing its excitation?

   a. Semiconductor b. Ruby

   c. Helium-neon d. Neodymium-YAG

12. For a step-index fiber the NA across the core

   a. varies b. will be opposite

   c. is constant d. is independent

13. Developed the first laser

   a. Charles Townes b. Theodore Maiman

   c. Gordon McKenzie d. Albert Einstein

14. Which color has the shortest wavelength of light?

a. Red b. Yellow c. Blue d. Green

15. The core of an optical fiber has a

a. Lower refracted index than air.

b. Lower refractive index than the cladding.

c. Higher refractive index than the cladding.

d. Similar refractive index with the cladding.

16. _____is the different angle of entry of light into an optical fiber when the diameter of the core is many times the wavelength of the light transmitted.

a. Acceptance angle b. Modes

c. Sensors d. Aperture

17. The loss in signal power as light travels down a fiber is called

a. Dispersion b. Scattering

c. Absorption d. Attenuation

18. _____is the width of the range of wavelengths emitted by the light source

a. Bandwidth b. Chromatic Dispersion

c. Spectral width d. Beamwidth

19. The cladding which surrounds the fiber core

a. is used to reduce optical interference.

b. is used to protect the fiber.

c. acts to help guide the light in the core.

d. ensures that the refractive index remains constant.

20. The three major groups in the optical system are

a. the components, the data rate and response time.

b. the source, the link, and the receiver.

c. the transmitter, the cable, and the receiver.

d. the source, the link, and the detector.

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