MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

EC-703B

OPTICAL COMMUNICATION AND N/W

Time Allotted: 3 Hours | Full Marks: 70

The questions are of equal value.
The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable.
All symbols are of usual significance.

GROUP A
(Multiple Choice Type Questions)

1. Answer any *ten* questions. $10 \times 1 = 10$

(i) The material of Optical fiber is

(A) SiO_2 (B) Polymer
(C) Both (A) and (B) (D) ZnO_2

(ii) Acceptance angle of Optical fiber

(A) $2\sin^{-1}(NA)$ (B) $\sin^{-1}(NA)$
(C) $\tan^{-1}(NA)$ (D) n2/n1

(iii) The material for making an efficient LED should be

(A) a metal
(B) a direct band gap semiconductor
(C) an indirect band gap semiconductor
(D) an insulator

(iv) A step index fiber has core with r.i.1.5 and a cladding r.i. of 1.46. Its NA is

(A) 0.156 (B) 0.244
(C) 0.344 (D) 0.486

(v) The channel for optical communication can be

(A) optical fiber cable only
(B) free space only
(C) free space and /or optical fiber cable
(D) brass cable only

(vi) For a single mode optical fiber which type of source is suitable?

(A) Tungsten filament bulb (B) LED
(C) Laser diode (D) Sodium vapor lamp

(vii) Modulation used in fiber optic communication are

(A) PCM (B) FSK
(C) ASK (D) Both ASK and PCM

(viii) Gain in EDFA depends on the following factors

(A) doping concentration (B) length of doped fiber
(C) pump power (D) all of these

(ix) Traditionally Optical fiber link is

(A) intensity modulated (B) frequency modulated
(C) phase modulated (D) none of these

(x) In long distance communication the source used is

(A) Argon laser (B) He-Ne laser
(C) Semiconductor laser (D) LED

(xi) The most common internet protocol

(A) SONET (B) SDH
(C) Ethernet (D) None of these

(xii) The emission spectra of EDFA (Erbium doped fiber amplifier)

(A) 850 nm – 950 nm (B) 1550 nm – 1650 nm

(C) 1250 nm – 1350 nm (D) none of these

GROUP B
(Short Answer Type Questions)

Answer any *three* questions. 3×5 = 15

2. Explain the advantages of an Optical Communication system. 5

3. Explain intermodal dispersion. What are dispersion-flattened fibers? 2+3

4. What are shot noise and Johnson noise? Calculate the signal to noise ratio of *p-i-n* photo detector. 2+3

5. Define acceptance angle and numerical aperture of a fiber. How are they related? 5

6. Discuss the topology used in FDDI system for high speed data communication. 5

GROUP C
(Long Answer Type Questions)

Answer any *three* questions. 3×15 = 45

7. (a) Discuss different types of losses found in optical fiber communication system. 10

(b) The core and cladding refractive index of a multimode fiber are 1.503 and 1.500 and the operating wavelength is 1.55μm. Calculate the critical radius of curvature at which large bending losses occurs. 5

8. (a) What are the differences in LED and laser? 3

(b) With the help if energy-band diagram, explain the working principle of double heterojunction LED. 6

(c) What do you mean by injection laser diode (ILD)? What are active volume and mode volume of an ILD? 6

9. Name different multiplexing technique used in optical fiber communication with brief description of each of them. Describe wavelength division multiplexing (WDM) in detail considering its bandwidth, low dispersion, usage with other multiplexing techniques and advantages. 7+8

10.(a) Draw a block diagram and explain the different components of a fiber optic link. 12

(b) Compare the fiber optic link with a satellite link. 3

11.(a) Write a detailed comparison between satellite communication and optical fiber communication. 5

(b) Explain the structure and functioning of a GRIN optical fiber. 5

(c) Write down the operating principle of EDFA. 5

12. Write short notes on any three of the following: 3×5

(a) Quantum well Lasers

(b) PIN photo diode

(c) SONET / SDH

(d) LAN

(e) Coherent detection and Direct detection

(f) Optical Multiplexer.