

6. (a) Describe the Wavelength division multiplexing (WDM) and compare with Dense wavelength division multiplexing (DWDM). 7.5
- (b) What is the need of rise time budget in optical communication ? Explain the process of rise time budgeting done in optical networks. 7.5

Section D

7. (a) What is the need of optical amplifiers ? Explain Erbium doped fiber amplifier (EDFA) with neat diagram. 7.5
- (b) Explain the basic principle of operation of semiconductor optical amplifier with neat diagram. Also give its applications. 7.5
8. (a) What are the differences between splices and connectors ? Explain different types of splices with neat diagram. 7.5
- (b) A 60/120 μm graded-index fiber with a numerical aperture of 0.25 and a profile parameter of 1.9 is jointed with a 50/120 μm graded-index fiber with a numerical aperture of 0.20 and a profile parameter of 2.1. If the fiber axes are perfectly aligned and there is no air gap, calculate the insertion loss at the joint in the forward and backward directions. 7.5

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B. Tech. EXAMINATION, 2021

Semester VII (CBCS)

OPTICAL COMMUNICATION

EC-703

Time : 2 Hours

Maximum Marks : 60

The candidates shall limit their answers precisely within 20 pages only (A4 size sheets/assignment sheets), no extra sheet allowed. The candidates should write only on one side of the page and the back side of the page should remain blank. Only blue ball pen is admissible.

Note : Attempt *Four* questions in all, selecting *one* question from any of the Sections A, B, C and D. Q. No. 9 is compulsory.

Section A

1. (a) Explain, what do you mean by a step index and graded index optical fiber ? Giving an expression for the possible refractive index profile. Why a graded index fiber with a parabolic index profile is preferred ? 7.5

- (b) An optical fiber has a numerical aperture of 0.20 and a cladding refractive index of 1.59. Determine :
- (i) The acceptance angle for the fiber in water which has a refractive index of 1.33.
- (ii) The critical angle at the core-cladding interface. **7.5**

2. (a) Explain the advantages, disadvantages and applications of optical fiber communication with proper explanation. **7.5**
- (b) A multimode step index fiber with a core diameter of 80 μm and a relative index difference of 1.5% is operating at a wavelength of 0.85 μm . If the core refractive index is 1.48, estimate :
- (i) The normalized frequency for fiber
- (ii) The number of guided modes. **7.5**

Section B

3. (a) What is Dispersion ? Explain and compare the dispersion shifted cable and dispersion flattened cable with neat diagram. **7.5**
- (b) What is meaning of scattering ? Explain the different types of scattering observed in optical communication. **7.5**

4. (a) Describe the following characteristics of injection LASER : **7.5**
- (i) Frequency chirp
- (ii) Noise
- (iii) Reliability
- (iv) Threshold current temperature dependence.
- (b) The radiative and non-radiative recombination lifetimes of the minority carriers in the active region of a double heterojunctions LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA. **7.5**

Section C

5. (a) Explain the following terms of photodiode : **7.5**
- (i) Quantum efficiency
- (ii) Responsivity.
- (b) What are the advantages of Avalanche photodiode (APD) over PIN diode ? Explain the neat diagram. Also describe and drawbacks of APD. **7.5**

(Compulsory Question)

9. (a) Write a short note on Goss-Hanschen shift. 4
- (b) Compare the properties and applications of LASER and LED. 4
- (c) Describe the multichannel concept of optical transmission with neat diagram. 4
- (d) Explain the concept of expanded beam connectors use in optical communication. 3