



Course Title: Optical Fiber Communications

Department of Computer Science and Telecommunication Engineering
Year 3, Term 2, Final Examination (May 2025), Session 2020-21
Course Code: **CSTE 3207**, Full Marks: 70, Time: Four hours
Answer any **SEVEN** of the following questions.

1. a) What are the light sources for optical fiber? Write the role of light source for optical modulation. 2
b) Contrast between optical fiber communication and satellite communication. Which communication is better- justify your answer? 5
c) Compare between electrical BW and optical BW. 3
- 2.a) Draw the refractive index profile for single mode step index and multimode graded index fiber. 3
b) A fiber optic cable whose cladding and core have indices of refraction 1.40 and 1.62 respectively. Light enters the fiber from a balloon of saline solution which is often used in endoscopic procedures at the end of the fiber to increase visibility. Calculate maximum entrance cone for transmission of light through the fiber. Note that the refractive index of saline solution is 1.35. 4
c) Distinguish between multimode graded index fiber and multimode step index fiber. 3
- 3.a) How can the normalized frequency V number declare the fiber either single mode or multimode? 3
b) Why loss is arises for the increasing numerical aperture? 2
c) A fiber optic cable with a core diameter of 50 μm which have cladding and core indices of refraction 1.46 and 1.466 respectively. If the operating wavelength of the rays is 0.85 μm calculate the normalized frequency and the number of modes which the fiber will support. How can you determine the type of fiber from the above problem? 2+2+1=5
- 4.a) How does the bandgap influence to form heterostructure? 1
b) Compare between homostructure and heterostructure LEDs? 3
c) Determine the power radiated by an LED if it's internal quantum efficiency is 3% and it has operating wavelength of 670 nm with a device current of 50 mA. 3
d) Discuss the principle of Febry Perot Laser. 3
- 5.a) Draw the functional block diagram of an optical receiver and describe briefly its components that make it up. 6
b) What is the major function of a photodiode? What are the most commonly used photodetectors in optical communications? Briefly explain the working principle of avalanche photodiode. 4
- 6.a) What is attenuation in an optical fiber? Explain Rayleigh scattering of attenuatin in optical fiber. 4
b) What is the chromatic dispersion for a graded-index fiber if $S_0 = 0.097 \text{ ps}/(\text{nm}^2 \cdot \text{km})$, $\lambda_0 = 1343\text{nm}$, and $\lambda = 1300\text{nm}$? 2
c) What is fusion splices? Describe fusion splices technique with necessary figure. 4
- 7.a) What is NA? What is its importance in optical fiber? Prove that, $\text{NA} = n\sqrt{(2 \Delta)}$. 5
b) How critical incident angle and critical propagation angle is related? 2
c) Calculate the maximum transmission distance for a fiber link with an attenuation of 0.5 dB/km if the power launched is in 1mW and the receiver sensitivity is 50 μ W. 3
- 8.a) How the bandgap split when erbium is doped into silica fiber. Why is it advantageous for the amplification in the optical domain? 3
b) Write the features of SOA. 2
c) Calculate the fiber optic link budget for multimode fiber, operating wavelength 1310 nm for 10 km length. 5
- 9.a) Discuss ATM UNI cell format. 3
b) Compare between CWDM and DWDM. 3
c) Explain FDDI token ring mechanism 4