Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. / B. Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV/DEC 2024

ELECTRONICS AND COMMUNICATION ENGINEERING

Semester

EC7701 - OPTICAL COMMUNICATION

(Regulation 2015)

Time: 3hrs Max.Marks: 100

PART- A (10 x 2 = 20 Marks)

(Answer all Questions)

Q. No	Questions	Marks
1	100 μW optical power is launched at the input of a 10 km long optical fiber link operating at 850 nm. The output power available is 5 μW. Estimate the total attenuation in dB over the link length. What is the average attenuation per km?	2
2	A step-index fiber in air has a numerical aperture of 0.25. Calculate the acceptance angle in air for skew rays that change direction by 110° at each reflection.	2
3	Differentiate between group and phase delay.	2
4	What are the fiber nonlinearities?	2
5	An InGaAsP/ InP LED emits peak power at 1330 nm at a drive current of 60 mA. The values of radiative and non-radiative recombination lifetime are 20 ns and 80 ns respectively. Estimate the internal quantum efficiency of the LED.	2
6	What is meant by direct and external modulation in LASERS.	2
7	Give out the principles of Optical detection.	2
8	Define NEP.	2
9	What is the principal of optical amplifiers?	2
10	Define WDM systems.	2

PART- B (5 x 13 = 65 Marks)

(Restrict to a maximum of 2 subdivisions)

Q. No	Questions	Marks
11 (a)	Explain the mode theory of light propagation in optical fibers.	13
	(OR)	
11 (b)	Describe the main fiber fabrication techniques and their respective stages in detail.	13
12 (a) (i)	Explain scattering losses in fiber.	6
(ii)	Silica has an estimated fictive temperature of 1400 K with an isothermal compressibility of 7×10^{-11} m^2 N^{-1}. The refractive index and the photo-elastic coefficient for Silica are 1.46 and 0.286 respectively. Determine the theoretical	7

	attenuation in dB/km due to the fundamental Rayleigh scattering in Silica at optical wavelengths 850 nm, 1310 nm and 1550 nm. (Boltzmann's constant = 1.381x 10 -23 JK^{-1})	
	(OR)	
12 (b) (i)	Explain about SPM and XPM.	6
(ii)	Compare the threshold optical powers of stimulated Brillouin and Raman scattering within the fiber at an operating wavelength of 1250nm. The SM fiber has a core diameter of 5 μm with an attenuation of 0.5dB/km. The source used is a LASER diode with a bandwidth of 500 MHz	7
13 (a)	Explain the concept of power efficiency in LEDs. Discuss the factors that influence LED efficiency and how they impact the overall performance.	13
	(OR)	
13 (b)	What is FSO? Explain the role of laser sources in FSO communication. Discuss the key characteristics required for an ideal laser source in FSO systems.	13
14 (a)	Explain the working principle of an Avalanche Photodiode (APD). Discuss how it differs from a regular PIN photodiode and the role of avalanche multiplication in enhancing sensitivity.	13
	(OR)	
14 (b)	Discuss the advantages and limitations of using Intensity Modulation with Direct Detection (IMDD) in optical communication systems. How does it affect system performance in terms of signal quality and power efficiency?	13
15 (a)	Explain in detail about EDFA amplifiers	13
	(OR)	
15 (b)	Describe the SONET frame structure and explain how data is transmitted and synchronized across the network.	13

PART- C (1 x 15 = 15 Marks)

(Q.No. 16 is Compulsory)

Q. No	Questions	Marks
16 (i)	Determine the SNR of a photodiode at 10 V reverse bias operating at room temperature with 10 MΩ load at 100 Hz bandwidth with a total radiant flux of 10^{-10} W at 800nm. Assume the responsivity of the photodetector as 0.5 A/W and dark current as $600x10^{-12}$ A and room temperature is 27 deg Celsius.	10
(ii)	Calculate the number of modes at 850nm and 1200nm in a GRIN fiber with a parabolic-index profile, p=2, with core radius of 25micrometer, RI of core and cladding is 1.5 and 1.49.	5