Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech Degree S7 (R,S) (FT/WP/PT) Examination November 2025 (2019 Scheme)

Course Code: ECT413

Course Name: OPTICAL FIBER COMMUNICATION

Max. Marks: 100 **Duration: 3 Hours**

PART A

Answer all questions, each carries 3 marks. Marks

1		**Consider the interface between a glass with n_1=1.48 and air for which n_2=1. What is the critical angle for light travelling in the glass?**	(3)
2		**Write the relationship between the energy of the photon and its frequency.**	(3)
3		**What is meant by group velocity dispersion?**	(3)
4		**List out some principal requirements of a good fiber connector.**	(3)
5		**Justify the significance of lambertian pattern in LED.**	(3)
6		**Draw the frequency response of an optical source showing the electrical and optical 3 dB bandwidth points.**	(3)
7		**With a neat sketch justify the need for pump source in a generic optical amplifier.**	(3)
8		**List out the three possible configurations of an EDFA.**	(3)
9		**Write short notes on free space optics.**	(3)
10		**Justify the need for Add/Drop multiplexer in a WDM network.**	(3)

PART B

Answer any one full question from each module, each carries 14 marks.

Module I

11	a)	**Illustrate the types of optical fibers with refractive index profiles.**	(9)
	b)	**Consider a multi mode step index optical fiber has a core radius of 25 µm, a core index of 1.48, and an index difference Δ=0.01. Find the percentage of optical power that propagates in the cladding at 840 nm.**	(5)

OR

12	a)	**With the aid of cross sectional view describe the structure of index guiding PCF and Photonic Bandgap Fiber (PBG).**	(8)
	b)	**Consider a multimode step index fiber with a core diameter of 62.5 µm and**	(6)

a core cladding index difference of 1.5 percent. If the core refractive index is 1.48, determine the normalized frequency of the fiber and the total number of modes supported in the fiber at a wavelength of 850 nm.

Module II

13 a) **What is Absorption? List out the causes of absorption.** (5)

b) **What is waveguide dispersion? Derive the expression for group delay arising from waveguide dispersion**. (9)

OR

14 a) **Sketch and explain the modal electric field distributions induced by macrobending losses.** (8)

b) **With the aid of necessary equations and diagram describe the fiber splicing techniques** (6)

Module III

15 a) **Sketch the schematic of a high radiance surface emitting double heterojunction LED. Also justify the need for double heterostructre in an optical source.** (8)

b) **A double heterojunction LED emitting at a peak wavelength of 1310 nm has radiative and nonradiative recombination times of 30 and 100 ns, respectively. The drive current is 40 mA. Determine the bulk recombination time, the internal quantum efficiency and internal power level.** (6)

OR

16 a) **Draw the structure of a pin photodiode circuit with reverse bias. Also justify the statement "*An incident optical power level decays exponentially inside the device*".** (9)

b) **The quantum efficiency for InGaAs is 90% and it is operated at a wavelength of 1300 nm. Determine the responsivity of the detector.** (5)

Module IV

17 a) **With the aid of a neat energy level diagram elaborate the transition processes of Er^{3+} ions in silica and amplification mechanism of EDFA.** (10)

b) **What is Amplified Spontaneous Emission (ASE) noise?** (4)

OR

18 a) **Draw the setup for a typical Raman amplification system. Also explain the Stokes shift with the Raman gain spectrum.** (10)

b) **Compare the performance of EDFA, Raman amplifier and SOA in terms of gain, wavelength and bandwidth.** (4)

Module V

19 a) **With the aid of a neat block diagram elaborate the implementation of a typical WDM network.** (9)

b) **How does the demultiplexing function work with a fiber grating and an optical circulator?** (5)

OR

20 a) **Draw the trace of an OTDR and infer the backscattered waveform.** (9)

b) **How does the OTDR determine fiber fault location and refractive index?** (5)

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