Exam.Code:0969
Sub. Code: 34523

2124

M.E. (Electronics and Communication Engineering)
First Semester
ECE-1102: Fiber-Optics Communication Systems
(For UIET only)

Time allowed: 3 Hours **Max. Marks: 50**

***NOTE:** Attempt <u>five</u> questions in all, including Question No. I which is compulsory and selecting two questions from each Section.*

x-x-x

Q.1a)	Why the R.I. of core and cladding are different? Which one has greater R.I. and why?	(5×2)
b)	Distinguish Step index fibers and graded index fiber.	
c)	Which photo diode is used for a low power optical signal and why?	
d)	What is meant by mode and index profile?	
e)	What do you understand by double heterostructure? State its limitations.	
	Section A	
Q.2a)	What is the numerical aperture of an optical fiber? Deduce an expression for the same. Why partial reflection does not suffice the propagation of light?	(5)
b)	The relative refractive index difference between the core and the cladding of a graded index fiber is 0.7% when the refractive index at the core axis is 1.45.Estimate values for the numerical aperture of the fiber along the axis when the index profile is assumed to be triangular.	(5)
Q.3a)	Explain the differences between meridional and skew rays. For an InGaAsP laser diode operating at wavelength 1310nm, I=40mA, the output power is 3mW and the voltage across the diode is 1.4V. If the diode current is increased to 45mA, the optical output power increases to 4mW. Calculate external quantum efficiency and external power efficiency of the laser diode.	(5)
b)	Explain the working principle of distributed feedback laser with suitable block diagram. Also discuss its advantages and disadvantages.	(5)
Q.4a)	Explain the necessity of carrier confinement in semiconductor laser. Write short note on Four Wave Mixing.	(5)
b)	Differentiate material and waveguide dispersion.Discuss pulse broadening in graded index fibers with necessary equations.	(5)

P.T.O.

	Section B	
Q.5a)	Differentiate the PIN and APD photodetector.	(5)
b)	What is meant by responsivity? Photons of 1300nm wavelength are incident on a pn photodiode at a rate of 5×10^{10} $s^{-1}$and the electrons are collected at a rate of 2×10^{10} s^{-1}. Calculate the quantum efficiency and responsivity of the diode.	(5)
Q.6a)	How Raman scattering is used for amplifying the signal. Explain the advantages and limitations of Raman Amplifier.	(5)
b)	Differentiate the direct and external modulation. Explain with suitable diagram.	(5)
Q.7a)	A 1550 nm SM digital fiber optical link needs to operate at 565 Mbps over 50 km without repeaters. A single mode InGaAsP laser diode launched an average power of -13 dBm into the fiber. The fiber has a loss of 0.35 dB/km and there is a splice loss of 0.1 dB every km. The coupling loss at the receiver is 0.5 dB and receiver uses InGaAs APD with sensitivity -39 dBm. Excess penalty noises are predicted to be 1.5 dB. Set up the power budget link and system margin.	(5)
b)	Explain the principle of WDM system. Discuss the architecture and principle of EDFA.	(5)

x-x-x