Paper Code: EEC-701	**Roll No.**									

B.Tech.
Backpaper SEVENTH SEMESTER EXAMINATION, 2016-17
OPTICAL COMMUNICATION

[Time: 3 hrs.] [Max. Marks: 100]

Note- Attempt All questions. All questions carry equal marks.

1. Attempt any two of the following:- **(10x2=20)**

(a) Calculate Normalized frequency for an optical fiber and derive number of guided modes propagating within a step index fiber. A WDM optical transmission system is designedso that each channel has a spectral width of 0.8 nm. How many wavelength channels can be used in the C-band?
(b) Distinguish between the propagation parameters k,β and b.How are they interrelatedA graded index fiber with a parabolic index profile core has a refractive index at the core axis of 1.53 and a relative index difference of 2%.Estimate the maximum possible core diameter which allows single mode operation at wavelength of 1.33μm.
(c) State the requirements that are to be met in selecting materials for optical fibers.The density of fused silica is 2.6 g/cm^3.How many grams are needed for a 1-Km-ong 50 μm diameter fiber core? If the core material is to be deposited inside of the glass tube at a 0.5 g/min deposition rate, how long does it take to make the preform for this fiber.

2. Attempt any Four of the following:- **(5x4=20)**

(a) Explain Refraction,Scattering, Absorption losses, Birefringence phenomenon present in Optical Fiber wave guide.
(b) What is intramodal dispersion Derive various important parameters of graded index fiber.
(c) A graded index fiber with a parabolic profile supports the propagation of 700 guided modes. The fiber has a relative refractive index difference of 2%, acore refractive index of 1.45 and a core diameter of 75 μm. Calculate the wavelength of light propagating in the fiber. Further, estimate the maximum diameter of the fiber core which can give single-mode operation at the same wavelength.
(d) Discuss any two fiber opticAttenuation measurement techniques.
(e) Explain fiber splicing . Discuss various types of misalignment occurs while joining two fibers.
(f) Discuss with the support of figure modified chemical vapour deposition (MCVD) method..

3. Attempt any Four of the following: - **(5x4=20)**

(a) Discuss any two fiber optic connectors.
(b) A germanium *p–i–n* photodiode with active dimensions of 80 × 40 μm has a quantum efficiency of 55% when operating at a wavelength of 1.3 μm. The measured dark current at this wavelength is 9nA. Calculate the noise equivalent power and specific detectivity for the device. It may be assumed that dark current is the dominant noise source.
(c) Discuss the experimental setup for studying the measurment of refractive index profile.

(d) Calculate external quantum efficiency of Laser diode.Explain the working of surface emitting LEDs.

(e) What is population Inversion? Discuss the condition required for Lasing action. With suitable diagram explain the operation of FP Cavity Resonator diode.

(f) Discuss the concept of WDM and DWDM.

4. Attempt any two of the following:- **(10x2=20)**

(a) Discuss the significance of Photo detectors. Derive Photo detector noises. What is receiver Sensitivity. Explain? What is the role of quantum limit in BER calculation?

(b) Discuss digital receiver performance. What is receiver sensitivity? Explain the significance of Quantum limit.

(c) What are burst mode receivers? A germanium photodiode incorporated into anoptical fiber receiver working at a wavelength of 1.55 μm has a dark current of 450nA at the operating temperature. When the incident optical power at this wavelength is 10^{-6} W and the responsivity of the device is 0.7 A/W, shot noise dominates in the receiver. Determine the SNR in dB at the receiver when the post – detection bandwidth is 113MHz.

5. Attempt any two of the following:- **(10x2=20)**

(a) Explain the operational principle and implementation of WDM with diagram and mathematical equations.

(b) A GaAlAs laser diode operating at 850 nm and capable of coupling 1 mW(0dBm) into the fiber. Ten sections of cable each of 500 m long, has a 4 dB/km attenuation, and has connectors on both ends having connectors loss of 2dB/connector is available.It has p-i-n photo diode receiver and an avalanche photo diode receiver .Considering these components construct a 5 km link operating at 20 Mb/s. If the sensitivities of pin and APD receivers are -45 and -56 dBm, respectively, which receiver is to be used if 6 dB system operating margin is required.

(c) What is link Power budget? Explain the system considerations of point to point link design.