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Total No. of Questions: 09

B. Tech. (ECE) (Sem.– 7, 8)
OPTICAL FIBER COMMUNICATIONS

M Code: 57554

Subject Code: EC-404

Paper ID: [A0329]

Time: 3 Hrs.

Max. Marks: 60

INSTRUCTIONS TO CANDIDATES:

- SECTION-A is COMPULSORY** consisting of **TEN** questions carrying **TWO** marks each.
- SECTION-B** contains **FIVE** questions carrying **FIVE** marks each and students have to attempt any **FOUR** questions.
- SECTION-C** contains **THREE** questions carrying **TEN** marks each and students have to attempt any **TWO** questions.

SECTION A

- Explain components of a lightwave system.
 - Why graded index is less affected by dispersion than step index multi mode optical fibers?
 - Explain optical receiver sensitivity and give its units also.
 - What is the main difference between DCF and SMF fibers?
 - Why generally III-V alloys type semiconductor materials are used in fabrications of optical sources?
 - Give source limitations becoming obstacles in transmitter circuit design.
 - What is the importance of normalized frequency? Define it.
 - What are merits & demerits of preamplifiers circuits used in receiver circuits?
 - A photodiode has a quantum efficiency of 50% at a wavelength of $0.9\ \mu\text{m}$. Calculate its responsivity at $0.9\ \mu\text{m}$, Received optical power if the mean photocurrent is $10^{-6}\ \text{A}$, the corresponding number of received photons at this wavelength?
 - Give applications and advantages of subcarrier multiplexing used WDM optical networks.

SECTION B

2. Derive an expression for confinement factor Γ of single mode fiber defined as the fraction of total mode power contained inside the core. Use the Gaussian approximation for the fundamental fiber mode. Estimate Γ for $V = 2$.
3. Discuss with the aid of a block diagram, the function of an optical fiber receiver. In addition, describe possible techniques for automatic gain control in APD receivers.
4. Describe III – V alloys type semiconductor materials generally used for fabrications of optical sources. Suggest some names of materials for typical wavelengths.
5. Discuss light wave systems used for local area networks.
6. Discuss briefly subcarrier multiplexing used in WDM light wave systems.

SECTION C

7. a) Derive an expression for the sensitivity of an APD receiver by taking into account a finite extinction ratio for the general case in which both shot noise and thermal noise contribute to the receiver sensitivity. You can neglect the dark current.
b) Consider a $0.8 \mu\text{m}$ receiver with a silicon p-i-n photodiode. Assume 20 MHz bandwidth, 65% quantum efficiency, 1 nA dark current, 8 pF junction capacitance, and 3 dB amplifier noise figure. The receiver is illuminated with $5 \mu\text{W}$ of optical power. Determine the RMS noise current due to shot noise current, thermal noise, and amplifier noise. Also calculate the SNR.
8. List and explain the recent developments in the field of optical communication. How the nonlinear effects are restricting the data rates? Explain.
9. Explain in detail loss limited light wave system and dispersion limited light system.