

SECTION-B

2. a. Which of the following detectors would be the best choice for a single mode optical fiber communication system if the optical source is a DFB laser with an emission wavelength of $\lambda = 1.55 \mu\text{m}$? Explain your choice.
 - a) a silicon PIN photodiode
 - b) a silicon APD photodiode
 - c) an indium gallium arsenide PIN photodiode (3)
- b. Write short notes on SONET and SDH. (2)
3. You are using a DFB laser as a source for a fiber system. You can choose between single-mode SI, single-mode GRIN, multi-mode SI, and multi-mode GRIN fibers. What is the best choice (assuming that the core diameters and the Δ s are the same for the single-mode fibers, and the core diameters and the Δ s of the multi-mode fibers are the same)? Briefly explain your choice. (5)
4. List various fiber non-linearities. Explain how they degrade the performance of an optical communication system or Network. What is the permissible BER in case of ordinary optical communications and WDM networks? (5)
5. Approximately how many modes will an optical fiber with a core diameter of $100 \mu\text{m}$ and a cladding diameter of $250 \mu\text{m}$ support if the core index is 1.5 and the clad index is 1.48? Assume that the radiation propagating in the fiber has a free space wavelength of $0.98 \mu\text{m}$. (5)
6. Describe the construction of APD and list the various characteristics of APD. (5)

SECTION-C

7. a. A SI fiber has core refractive index of $n_1 = 1.655$, and a cladding index of $n_2 = 1.650$. The normalized frequency V is 2.1 if the source wavelength is $\lambda = 1.55 \mu\text{m}$. (5)
 - a) What is the core radius of this fiber?
 - b) What is the numerical aperture (NA) of this fiber?
 - c) What is the spot-size of this fiber?
 - d) How many modes can propagate in this fiber? Briefly explain your answers.
- b. What are the major methods of fiber preforms? Explain any one in detail. (5)

8.
 - a. Write short note on optical modulators and their applications. What is the impact of chirping on modulator performance? (4)
 - b. What do you understand by bandwidth distance product and what is a bitrate limitation due to GVD? (3)
 - c. Is there any advantage of using hetro junctions in optical devices? Explain. (3)
9.
 - a. What is the reason of OH absorption peaks for a typical optical spectrum? (3)
 - b. For a single mode fiber, the V parameter is typically chosen to be between 2 and 2.4.
 - a) Why is the lower limit typically about 2?
 - b) Why is the upper limit about 2.4? (4)
 - c. If the index of refraction of a material is independent of wavelength (the index has the same value at all wavelengths), would
 - a) Material dispersion exist. Briefly explain
 - b) Waveguide dispersion exist. Briefly explain
 - c) Modal distortion exist. Briefly explain (3)