B.E. Electronics & Communication/Telecommunication Engineering (Model Curriculum)
Semester-VII
ET701M - Fiber Optic Communications

P. Pages : 2
Time : Three Hours

GUG/S/25/14247
Max. Marks : 80

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Notes : 1. All questions carry equal marks.
2. Assume suitable data wherever necessary.
3. Illustrate your answers wherever necessary with the help of neat sketches.

1. a) What is optical fiber? Draw and explain the structure of optical fiber also state their advantages and disadvantages. **8**

b) Explain **8**
1) Refraction
2) Refractive Index
3) Law of reflection
4) Critical angle

OR

2. a) The velocity of light in the core of step index fiber is $2.01 \times 10^8 \, m/s$ and the critical angle at the core clad interface is 80°. Determine the numerical aperture and the acceptance angle for the fiber in air. Assuming it has a core diameter suitable for consideration by ray analysis. **8**

b) What is step index fiber? Explain step index fiber with mathematical expression. **8**

3. a) What is dispression. Derive an expression of material dispersion also state the factor responsible for material dispersion. **8**

b) An optical fiber is described as follows **4**
a) Length= 120m
b) Optical power provided = $12 \mu W$
c) Output power = $8 \mu W$
Find out the loss of the optical fiber a dB/km

c) What is connector? State the types of connector and explain any one type of connector with neat diagram. **4**

OR

4. a) What is splicing. Explain the steps of fusion splicing with neat diagram. **8**

b) Explain different types of fiber joint losses with neat diagram. **8**

5. a) With the help of energy band diagram explain direct and indirect band gap semiconductor materials. **8**

b) An InGaAsP surface emitter has an activation energy of 1eV with a constant of proportionality (β_0) of $1.84 \times 10^7 \, h^{-1}$. Estimate the CW operating lifetime for the LED with a constant junction temperature of 17ºC, if it is assumed that the device is no longer useful when its optical output power has diminished to 0.67 of its original value.   **8**

OR

6. a) What is Edge emitting LED? Explain the operation of Edge emitting LED with neat construction.   **8**

b) What are the requirement of optical source? With the help of energy band diagram explain the working principle of LED optical source.   **8**

7. a) When 3×10^{11} photons each with a wavelength of $0.85 \, \mu m$ are incident on a photodiode, on average 1.2×10^{11} electrons are collected at the terminals of the device. Determine the quantum efficiency and the responsivity of the photodiode at $0.85 \, \mu m$.   **8**

b) Draw the structures of Avalanche photo detectors and explain their operations.   **8**

OR

8. a) Define   **8**
   i) Quntum efficiency.
   ii) Responsivity
   iii) Noise Equivalent power
   iv) Detectivity
   v) Dark current
   vi) Spectral response

b) A given silicon avalanche photo diode has a quantum efficiency of 65% at a wavelength of 900 nm. Suppose $0.5 \, \mu W$ of optical power produces a multiplied photocurrent of $10 \, \mu A$. Find the avalanche gain.   **8**

9. a) Define STM and state their units with bitrates. Also draw and explain the frame format of STM-1.   **8**

b) What is GPON? With the help of neat block diagram explain elements of GPON.   **8**

OR

10. a) Define   **8**
   i) Network topology
   ii) Networking nodes
   iii) Network switching nodes
   iv) Virtual Circuits

b) Explain experimental arrangement for the measurement of spectral loss in optical fibers using the cut-back technique.   **8**

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