B.E. Electronics & Communication/Telecommunication Engineering (MODEL CURRICULUM)
Semester-VII

ET701M - Fiber Optic Communications

P. Pages : 2 **GUG/W/22/14247**

Time : Three Hours * 3 5 4 7 * Max. Marks : 80

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

1. a) Define numerical aperture. Derive an expression for numerical aperture of a step index fiber. **8**

b) Design a single mode fiber with v = 2.3 for operation at 1.55 micron with fused silica core nl = 1 .458 and a numerical aperture of 0.1. **8**
Find
1) The cladding index n2 and radius of the fiber.
2) Calculate the Approximate number of modes for operation at 1200 nm

OR

2. a) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.50 and cladding refractive index of 1.47. **8**
Determine.
I) The critical angle of the core cladding interface.
II) The numerical aperture for fiber.
III) The acceptance angle in air for the fiber.

b) What is step index fiber? Prove that **8**

$$Mg = \frac{V^2}{2}$$

3. a) What is dispersion. Derive an expression of material dispersion. **8**

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

OR

4. a) What is splicing. Explain Fusion splicing techniques in details. **8**

b) What is dispersion? Derive an expression of waveguide dispersion. **8**
What do you mean by pulse broadening? Explain its effect on information carrying capacity of a fiber.

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

b) The radiative and nonradiative recombination lifetimes of the minority carriers in the active region of a double-heterojunction LED are 60 ns and 100 ns respectively. Determine the total carrier recombination lifetime and the power internally generated within the device when the peak emission wavelength is 0.87 μm at a drive current of 40 mA. **8**

OR

6. a) What is LASER. Explain Fabry Perat cavity LASER. **8**

b) An InGaAsP surface emitter has an activation energy of 1 eV with a constant of proportionality $(\beta 0)$ of 1.84 x 107 h-l. Estimate the CW operating lifetime for the LED with a constant junction temperature of 17 ºC, 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**

7. a) What is photo detector? Explain principle of operation of photo detector. **8**

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

OR

8. a) Define **8**
i) Quantum efficiency
ii) Responsivity
iii) Noise Equivalent Power
iv) Detectivity.

b) A silicon pin photodide has an intrinsic region with a width of 20μm and a diameter of 500μm in which the drift velocity of electrons is 10.5×10^{-13} F cm^{-1} Calculate **8**
i) Drift time of the carriers across the depletion region.
ii) Junction capacitance of the photodiode

9. a) Define WDM. Discuss the concept of WDM with neat diagram. **8**

b) What is SDH? Explain the network elements of SDH with schematic diagram. **8**

OR

10. a) With the help of neat block diagram explain elements of GPON. **8**

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

****