2019

MSc

4th Semester Examination

ELECTRONICS

PAPER – ELC-404

Full Marks : 50

Time : 2 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

Answer Question no. 1 and any *THREE* from the rest.

1. (a) Distinguish between single mode and multimode fiber. 2x5

(b) What are the basic differences between LASER and LED ?

(C) What do you mean by intrinsic losses in optical fiber communication?

(d) Write down the Fermi Golden Rule. Mention its physical significance .

(e) What is Raman effect ?

2. (a) Derive the expression for second order perturbation in energy when time Independent perturbation is in action . 4+(4+2)

(b) Determine the $0^{th}$, $1^{st}$., $2^{nd}$. order perturbations and so on in energy, considering a perturbation of the form ½ $bx^2$ to the linear harmonic oscillater. Verify your result with the exact solution . 4+(4+2)

3. (a) What is material dispersion in an optical fiber? Derive the expression of material Dispersion.

(b) The refractive indices of the core and cladding of a step-index fiber are 1.48 and 1.465 respectively. Light of wavelength $\lambda = 0.85$ μm is guided through the optical fiber, Calculate the minimum and maximum values of the propagation constant β. (1+6)+3

4.(a) Explain the basic mechanism of optical amplification in an Erbium doped fiber Amplifier.

(b) Discuss the functioning of electronic repeaters in long-haul fiber optic communication systems.

(c) What is WDM? What are the advantages of WDM over TDM? 4+2+(2+2)

5. (a) Define the internal quantum efficiency of an LED. Derive the expression for it . (1+5)+4

(b) The radiative and nonradiative recombination lifetimes of the minority carriers in the active region of a double – heterojunction LED are 60 ns and 100ns 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 .

6. (a) Derive the expression for nonlinear coefficient $n_2$ in an optical fiber .

(b) Explain how the power variation within a pulse leads to its own phase Modulation.

(c) Mention the basic difference between GVD (Group velocity Dispersion) and SPM (self- phase modulation). 5+3+2