2022

M.Sc.

4th Semester Examination

ELECTRONICS

PAPER—ELC-404

OPTICAL COMMUNICATION AND INFORMATION PROCESSING

Full Marks : 50

Time : 2 Hours

The figures in the margin indicate full marks.

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

Illustrate the answers wherever necessary.

1. Answer any *four* questions : 4×2

(a) How optical confinement can be enhanced in a *double heterojunction diode ?* 2

(b) What is self phase modulation ? 2

(c) Explain why absolute monochromaticity of an electromagnetic radiation is an unattainable goal. 2

(d) Explain quasi-equilibrium condition of a semiconductor laser. 2

(e) Why should the direct bandgap semiconducting materials be generally used for developing optoelectronic devices ? 2

(f) Using time independent perturbation theory derive the 1st order perturbation in energy. 2

2. Answer any *four* questions : 4×4

(a) Explain the basic principle of light propagation in an optical fiber. 4

(b) Derive an expression for material dispersion in an optical fiber. 4

(c) Explain the working principle of an optical fiber directional coupler. 4

(d) Explain briefly basic LED configuration used for optical fiber communication. 4

(e) Write a short note on splice loss in optical fiber communication system. 4

(f) Explain the intermodal dispersion in optical communication system. 4

3. Answer any *two* questions : 2×8

(a) Find an expression for transition probability per unit time using time dependent perturbation theory. Consider a step-index fiber with $\Delta = 0.002$. Assume $n_2 = 1.45$. Calculate the core-radius so that the cut-off wavelength is 1150nm. 5+3

(b) Discuss with a neat energy band diagram the mechanism of a semiconductor laser. Explain the communication requirements in choice of an optical source. 5+3

(c) Explain power budgeting and rise time budgeting in optical link design. What is BER? Give its significance. (3+3)+(1+1)

(d) Discuss about optical CDMA. Derive the expressions of the quantum efficiency and responsivity of a PIN photo detector. 4+4

[Internal Assessment – 10]

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