

Eighth Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Optical Fibre Communication

Time: 3 hrs.

Max. Marks: 100

Note : Answer any FIVE full questions.

- 1
 - a. Explain with necessary diagrams the different types of fibre structures. (08 Marks)
 - b. What is numerical aperture? Derive an expression for numerical aperture and maximum acceptance angle in case of a step index optical fibre in terms of refractive index of core and cladding material. (06 Marks)
 - c. Draw a design curve of fractional refractive index $\Delta \frac{V}{S}$ the core radius a ($1 \mu\text{m} \leq a \leq 7 \mu\text{m}$) for a silica core ($n_1 = 1.450$) single mode fibre to operate at 1300 nm (take $V = 2.25$). Let the optical fibre to be selected from this curve be of 5 μm core radius. Is this fibre still single mode at 820 nm? Compute the wavelength beyond which this fibre ceases to be a single mode fibre. (06 Marks)
- 2
 - a. Discuss the following for optical fibres :
 - i) Absorption.
 - ii) Wave guide dispersion.
 - iii) Material dispersion.
 - iv) Bending loss. (16 Marks)
 - b. With a ray theory, show that the pulse delay distortion in a step index multimode fibre is given by, $\tau = n_1 \Delta \frac{L}{C}$, where the parameters have their usual meaning. (04 Marks)
- 3
 - a. Explain the operation of DFB and DBR LASERS. (08 Marks)
 - b. Explain the operation of an APD. (06 Marks)
 - c. A p-i-n photodiode has a quantum efficiency of 65% at a wave length of 0.8 μm , determine
 - i) The mean photo current when the detector is illuminated at 0.8 μm with 5 μW of optical power.
 - ii) The rms quantum noise current in a post detection bandwidth of 20 MHz.
 - iii) The SNR in dB. (06 Marks)
- 4
 - a. Show that $P_{\text{LEP, step}} = P_s (NA)^2$ for $r_s < a$. (10 Marks)
 - b. Describe the different types of mechanical misalignment between the two joined fibres. (06 Marks)
 - c. Explain fusion splicing method with a neat sketch. (04 Marks)
- 5
 - a. Derive an expression for different noise sources in an optical receiver. (10 Marks)
 - b. Explain the operation of high impedance pre amplifier using FET. (10 Marks)
- 6
 - a. Explain the basic elements of an analog link with different noise contribution. (10 Marks)
 - b. Describe a multichannel A.M. technique. (05 Marks)
 - c. What is sub carrier multiplexing? Explain. (05 Marks)
- 7
 - a. Explain link power budget and system rise time budget analysis. (10 Marks)
 - b. A fibre path 50 km long consists of section of fibre, each having a maximum length of 3 km, spliced together to form one continuous fibre. The attenuation of the fibre is 0.5 dB/km. The splices have added losses of 0.3 dB per splice. Connectors at each end, to connect to the transmitter and receiver, have added loss of 1 dB per connector.
 - i) What is the total loss in dB between the transmitter and receiver?
 - ii) What is the power output to the receiver when the power input at the transmitter is 1 mW. (06 Marks)
 - c. Discuss different types of line codes in OFC system. (04 Marks)
- 8
 - a. What is WDM? How it is accomplished? (06 Marks)
 - b. Describe 8×8 star coupler formed by inter connecting twelve 2×2 couplers. (08 Marks)
 - c. Describe the working of an Erbium doped fibre amplifier. (06 Marks)

