Total No. of Questions : 12]

SEAT No. :

P3366

[Total No. of Pages : 3

[4959]-100
B.E.(E&TC)
OPTICAL FIBER COMMUNICATION
(2008 Pattern) (Semester-II)

Time :3Hours] *[Max. Marks :100*

Instructions to the candidates:

1) ***AnswerQ.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6 form section I and Q.7 or Q.8,Q.9 or Q.10,Q.11 or Q.12 form section II***
2) ***Answers to the two sections should be writtern in separate books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Assume suitable data if necessary.***

SECTION-I

Q1) a) State the advantages and limitations of optical fiber communication system. **[6]**

b) A step index fiber in air has a core refractive index 1.45 and core diameter 60μ m. Numerical aperture of the fiber is 0.16. Calculate. **[12]**

i) cladding refractive index

ii) normalized frequency for the fiber when light at a wavelength of 0.9 μm is transmitted

iii) critical angle

iv) acceptance angle

v) number of guided modes propagating in fiber

vi) fraction of power residing in the cladding if the totla optical power in the fiber is1m W

OR

Q2) a) A manufacturer wishes to make a silica core step index fiber with V=75 and a numerical aperture NA=0.3 to be used at 820nm. If n_1=1.458 what should be the core size and cladding index be? **[8]**

b) Explain multimode step index and multimode graded index fibers. **[6]**

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c) With a neat diagram describe briefly optical fiber cable structure. **[4]**

Q3) a) Describe linear scattering loss in optical fibers with regard to:

i) Rayleigh scattering

ii) Mie scattering. **[8]**

b) A continuous 40km long optical fiber link has a loss of 0.4db/km?

i) What is the minimum optical power level that must be launched into the fiber to maintain an optical power level of 2μW at the receiving end?

ii) What is the required input power if the fiber has a loss of 0.6db/km? **[8]**

OR

Q4) a) The material dispersion in an optical fiber defined by $\left|\frac{d^2 n_1}{d\lambda^2}\right|$ is 4.0×10^{-2} μm^{-2}. Estimate the pluse broadening per kilometer due to material dispersion within the fiber when it is illuminated with an LED source with peak wavelength of 0.9μm and an rms spectral width of 45nm. **[8]**

b) What is dispersion? Explain material dispersion. **[8]**

Q5) a) What is fiber splice? List different splicing techniques. Explain in brief fusion splicing. **[8]**

b) A DH InGaAsP LED emitting at a peak wavelength of 1310nm has radiative and nonradiative recombination times of 30 and 90ns respectively. The drive current is 40mA. **[8]**

i) Find the internal quantum efficiency

ii) Find the internal power level.

OR

Q6) a) State and explain the requirements of a good optical source. **[8]**

b) A GaAIAs laser diode has a 500μ m cavity length which has an effective absorption coefficient of $10cm^{-1}$. For uncoated facets the reflectivities are 0.32 at each end. What is the optical gain at lasing threshold? If the internal quantum efficiency is 0.65 what is the external quantum efficiency? **[8]**

SECTION-II

Q7) a) Explain the working of avalanche photodetector with a neat diagram. **[8]**

b) The following measurements were taken for an APD. Calculate the multiplication factor for the device.

Received optical power at 1.35μm =0.2 μW

Corresponding output photocurrent(after avalanche gain)=4.9μA

Quantum efficiency at 1.35 μm =40% **[10]**

OR

Q8) a) Write a short note on receiver noise. **[8]**

b) Discuss the three main amplifier configurations currently adopted for optical fiber communication.Comment on their relative merits and drawbacks. **[10]**

Q9) a) Write a short note on multichannel amplitude modulation. **[8]**

b) Explain rise time budget in optical fiber communication system. **[8]**

OR

Q10) a) Describe the system considerations in establishing point to point optical fiber link. **[8]**

b) A 1550 nm single mode digital fiber optic link needs to operate at 622Mb/s over 90km without amplifiers. A single mode InGaAsP laser launches an average optical power of 13 dBm into the fiber. The fiber has a loss of 0.35dB/km and there is a splice with a loss of 0.1dB every kilometer. The coupling loss at the receiver is 0.5dB and the receiver uses an InGaAs APD with a sensitivity of -39dBm. Excess noise penalties are predicted to be 1.5dB. Set up an optical power budget for this link and find the system margin. **[8]**

Q11) a) Write a short note on optical amplifier. **[8]**

b) An InGaAsP optical amplifier has an active area width 5μm, active area thickness0.5 μm and amplifier length 200μm. If 100mA bias current is applied, find the pumping rate. **[8]**

OR

Q12) Write short notes on(any two): **[16]**

a) WDM components.

b) Operation of EDFA amplifier

c) WDM couplers/splitters

d) WDM technique