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10EC/TE72

Seventh Semester B.E. Degree Examination, May 2017
Optical Fiber Communication

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. Discuss briefly the inherent advantages of optical fibers over conventional copper systems. **(08 Marks)**

b. Explain the structure of single mode and multimode step index and graded-index optical fibers with cross section and ray path. **(07 Marks)**

c. Calculate the number of modes of an optical fiber having diameter of 60 μm, $n_1 = 1.48$, $n_2 = 1.44$ and $\lambda = 1.33$ μm. **(05 Marks)**

2 a. Derive an expression for material dispersion which is a function of wavelength using time delay. **(08 Marks)**

b. Consider a 30-km long optical fiber that has an attenuation of 0.8 dB/km at 1300 nm. Find the optical output power P_{out}, if 200 μwatts of optical power is launched into the fiber. **(06 Marks)**

c. Prove that delay difference between the axial ray and extreme meridional ray is $\delta T_s \cong \frac{Ln_1\Delta}{C}$ **(06 Marks)**

3 a. Draw and explain the cross sectional view of a typical Ga Al As double heterostructure LED, along with energy band diagram and variations in RI profile. **(10 Marks)**

b. Explain the operation of avalanche photodiode with schematic diagram and separate absorption and multiplication (SAM)APD configuration. **(10 Marks)**

4 a. List and sketch different types of splicing techniques and connectors. **(08 Marks)**

b. A GaAs optical source with a refractive index of 3.6 is coupled to a silica fiber that has a RI of 1.48. If the fiber end and source are in close physical contact, then determine Fresnel reflection at the interface and hence power loss in dB. **(06 Marks)**

c. Explain various lensing schemes used to improve optical source to-fiber coupling efficiency with neat diagrams. **(06 Marks)**

PART – B

5 a. Explain with a neat diagram, the basic sections and operations of an optical receiver. **(07 Marks)**

b. Derive an equation for optical receiver sensitivity. **(08 Marks)**

c. Explain Homodyne detection. **(05 Marks)**

6 a. Discuss the subcarrier multiplexing technique with a neat relevant diagram. **(06 Marks)**

b. Derive expression for carrier to noise ratio, considering the various noise contributors of an analog optical communication link having single AM channel. **(10 Marks)**

c. Write a note on microwave photonics. **(04 Marks)**

7 a. Explain operational principle and implementation of WDM. **(08 Marks)**

b. Discuss the three key transition process involved in LASER action with neat energy band diagrams. **(04 Marks)**

c. Explain the importance of following active optical components used in WDM based on MEMS:

(i) Variable optical attenuators

(ii) Tunable optical filters **(08 Marks)**

8 a. Explain three main optical amplifier types. **(06 Marks)**

b. Consider an EDFA being pumped at 980 nm with a 30 mW – pump source power. If the gain at 1550 nm is 20 dB then find maximum i/p and out powers. **(04 Marks)**

c. Describe the SONET 2-fiber unidirectional path switched ring and 4-fiber BLSR with neat sketches. **(10 Marks)**

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