CRASH COURSE

USN ☐☐☐☐☐☐☐☐☐☐   **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 $\delta T_s \cong \dfrac{Ln_1\Delta}{C}$
   (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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