5th Semester Regular / Back Examination 2015-16
FIBER OPTICS AND OPTOELECTRONICS DEVICES
BRANCH: MME
Time: 3 Hours
Max Marks: 70
Q.CODE: T673
Answer Question No.1 which is compulsory and any five from the rest.
The figures in the right hand margin indicate marks.

Q1   Answer the following questions: **(2 x 10)**
   a) What is third window in optical communication?
   b) Which fiber is used in long distance communication?
   c) Draw a schematic diagram showing signal propagation in step index fiber and graded index fiber
   d) If LP_{32} mode is propagating in a fiber, draw a schematic distribution of intensity at the output of the fiber
   e) Distinguish between intermodal and intramodal dispersion .Which dispersion is absent in a single mode fiber?
   f) Mention the different types of splicing techniques
   g) Distinguish between an isolator and Circulator. Draw necessary diagrams
   h) What is rise time of a source .How it is related to its 3decibel Band width?
   i) Explain the principle of modulator based on electro optic effect.
   j) What is optical bistability? Can this principle be used for optical switching?

Q2 a) Assuming ray propagation of light, derive an expression for numerical aperture in terms of acceptance angle. What is the physical significance of numerical aperture?   **(5)**
   b) What is a mode?Distinguish between TE,TM,HE,EH and LP modes. Which modes propagate in an optical fiber?   **(5)**

Q3 a) Explain the double crucible method of fiber fabrication. How the refractive index of the core is controlled using this method?   **(5)**
   b) A multimode optical has a core diameter of 60μm and relative core cladding refractive index difference of 1.8%. It operates at a wavelength of 1550nm. The refractive index of the core of the fiber is 1.5. Then calculate refractive index of the cladding, V-number and total number of guided modes in the fiber   **(5)**

Q4 What is a double heterostructure PN junction? How carrier confinement and optical confinement are realized using this structure? Draw the schematic diagram of a long wavelength light emitting diode. Clearly mention the materials used in the different layers **(10)**

Q5 **a)** What is lensing scheme to improve the coupling efficiency between two fibers. Draw necessary diagrams to explain your answer. **(5)**

b) The mean optical power launched into an optical link is 1.5mW and the fiber has an attenuation of 0.5dBkm^{-1}. Determine the maximum possible link length without repeater (assuming losses connectors) when the minimum mean optical power level required at the detector is 2µW. **(5)**

Q6 **a)** Explain the detection principle in APD. How a PIN detector differs from APD. **(5)**

b) Find an expression for SNR for a PIN detector under thermal noise limited configuration **(5)**

Q7 **a)** Write down the rate equation for semiconductor optical amplifier. Explain the origin of different terms clearly **(5)**

b) With the help of energy level diagram, explain the principle of amplification in EDFA. **(5)**

Q8 Write short notes on any two: **(5 x 2)**
a) Working principle of Solar cell
b) Connector and splices
c) Reasons for attenuation in optical fiber
d) Basic components of a Laser device