Registration no:

5th Semester Regular / Back Examination 2016-17
FIBER OPTICS AND OPTOELECTRONICS DEVICES
BRANCH(S): METTA, MME
Time: 3 Hours
Max Marks: 70
Q.CODE: Y466
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) Distinguish between electrical and optical signal.
   b) Mention the drawback of graded Index fiber.
   c) What is attenuation constant? Write its mathematical expression in term of power.
   d) Why GaAs is a good candidate for optoelectronics devices?
   e) Why 193.5THz and 229THz called communications windows?
   f) The responsivity of a given p-i-n diode is 0.5 AW^{-1} for a wavelength of 1μm. What is the output photocurrent when optical power is 0.2 μW at the same wavelength?
   g) Define uniaxial and birefrigent crystal
   h) Differentiate Braggs from Raman-Nath modulator.
   i) Sketch the schematic diagram of SOA.
   j) Give the notion on optical switching.

Q2 **(a)** What do you mean by confinement factor in optical fiber? Explain its properties from suitable expressions.   **(5)**

   (b) Discuss various types of optical connectors including necessary diagrams   **(5)**

Q3 **a)** A pin photodiode on average generates one electron-hole pair per two incident photons at second and third optical communication window. Assuming all the photo-generated electrons are collected , calculate   **(6)**
   (i)   quantum efficiency of the diode
   (ii)   the maximum possible band gap energy (in eV) of the semiconductor , assuming the incident wavelength to be a long wavelength cut-off ;
   (iii)   the mean output photocurrent when the incident optical power is 10 μW.

   b) Derive mathematical expression for multipath dispersion?   **(4)**

Q4 **a)** Briefly discuss different optical components of WDM system. **(5)**

b) The speed of light in vacuum and in the core of SI fiber is 3×10^8 ms^{-1} and 2×10^8 ms^{-1} respectively. When the fiber is placed in air, the critical angle at the core-cladding interface is 75^0. Calculate the **(5)**

(i) numerical aperture of the fiber

(ii) multipath dispersion per unit time.

Q5 **a)** Describe the design, structure and principle of solar cell. **(5)**

b) A light emitting diode coupled to a step index fiber of core diameter larger than the emitting area of the LED, using transparent bonding cement. The refractive indices of the bonding cement and GaAs are respectively, 1.5 and 3.7 **(5)**

(i) If the mean lifetimes corresponding to radiative and nonradiative recombination's are taken to be the same for GaAs and equatl to 100 ns, calculate the internal quantum efficiency of the LED

(ii) Calculate the external quantum efficiency, assuming negligible self-absorption within the semiconductor.

Q6 **a)** What is the difference between the propagation constant, wave vector and normalized propagation constant? How are they related? **(5)**

b) Calculate the responsivity of an ideal p-n photodiode at first, second and third communication windows. **(5)**

Q7 Briefly discuss longitudinal electro-optic modulator. Write an expression for transmitted intensity with respect to applied field at $V \ll V_\pi$ **(10)**

Q8 **Write short answer on following** **(2.5 x 4)**

a) TIR

b) LASER

c) ILD

d) EDFA