

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
**FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015**  
**Electronics and Communication**  
**(Microwave and TV Engineering)**  
**01 EC 6211 : Optical Communication Systems**

Max Marks: 60

Duration: 3 Hours

(Answer any Two from Each Module)

**Part- A**

1. (a) Explain various non-linear effects occur in optical fibers.  
(b) A step index fiber has core refractive index is 1.48 and that of cladding is 1.46. If the outer medium is air and operating at 1300nm, Find (i) Maximum entrance angle. (ii) Numerical Aperture. (iii) Number of modes supported by the Fiber.  
(5+4=9 Marks)
2. (a) Explain the working principle of semiconductor lasers. How the longitudinal modes are controlled in them?  
(b) A junction LED emitting at peak wavelength of 1310nm has radiative and non radiative recombination times of 30ns and 100ns respectively. The drive current is 25mA. Find (i) Internal Quantum efficiency. (ii) Internal optical power generated (iii) Responsivity.  
(5+4=9 Marks)
3. (a) Derive the expression for SNR of a photo detector when the receiver performance is dominated by shot noise.  
(b) Find the quantum limit of photodetection for a BER of  $10^{-9}$   
(5+4=9 Marks)

**Part- B**

4. (a) Explain various dispersion compensation schemes in long haul lightwave systems.  
(b) A  $1.3\mu m$  lightwave system uses a 50-km fiber link and requires at least  $0.3\mu W$  at the receiver. The fiber loss is  $0.5dB/km$ . Fiber is spliced every 5 km and has two connectors of 1-dB loss at both ends. Splice loss is only 0.2 dB. Determine the minimum power that must be launched into the fiber. Add necessary system margin.  
(4+5=9 Marks)

5. Explain the characteristics of EDFA. Discuss a scheme for both C band and L band amplification using EDFA
- (9 Marks)

6. (a) Explain the operation of Semiconductor Optical Amplifier  
(b) Show that an ideal optical amplifier has a noise figure of 3dB.

(5+4=9 Marks)

### Part- C

7. (a) Briefly explain how solitons maintain their pulse shape in presence of dispersion and fiber losses.  
(b) Explain how soliton collisions limit the number of channels in a WDM soliton system.

(7+5=12 Marks)

8. Draw the block schematic of a synchronous coherent optical receiver and explain. Show how an electro optic material such as LiNbO<sub>3</sub> can be used for different modulation schemes in coherent optical systems.

(6+6=12 Marks)

9. (a) Calculate the sensitivity of a homodyne PSK receiver operating at  $\lambda = 1.55 \mu m$  in the shot noise limit. Assume that  $\eta = 0.8$  and  $\Delta f = 1 GHz$ .  
(b) Write short notes on tunable optical filters and AWG.

(6+6=12 Marks)

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