Registration No. : | | | | | | | | | | |

Total number of printed pages – 2

B. Tech

PEEC 4302

Fifth Semester Regular Examination – 2014

FIBER OPTICS AND OPTOELECTRONICS DEVICES

BRANCH(S) : EC, ELECTRICAL, ETC

QUESTION CODE : H 191

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

   (a) How a Graded Index fiber differs from a Step Index fiber ?

   (b) What is the advantage of using double hetero structure in optoelectronics device ?

   (c) What is Responsivity ?

   (d) Write the relation between Numerical Aperture and acceptance angle ?

   (e) Define the dispersion parameter and write its unit.

   (f) Differentiate between thermal noise and shot noise.

   (g) Give one example each of a direct band gap and indirect band gap semiconductor.

   (h) A multimode step index fiber has a relative index difference of 2% and a core refractive index of 1.5. The number of modes propagating at a wavelength of 1.3 μm is 1000. Calculate the diameter of the fiber core.

   (i) A step index single mode fiber has a core index of 1.48, relative refractive index difference of 0.27% and a core radius of 4.4 μm. Estimate the waveguide dispersion for this fiber at wavelength of 1.32 μm.

   (j) How is the fill factor defined for a solar cell ?

2. Explain the basic principle of optical amplifier and derive an expression for gain of a semiconductor optical amplifier. 10

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3. Two single mode fibers are joined together using a connector. List all possible losses that may occur. Also explain how these losses can be minimised. 10

4. (a) What are the different splicing techniques ? Explain them in brief. 5

   (b) A typical step index fiber has a core refractive index of 1.46, a relative refractive index difference of 0.003, and a core radius of 4 μm. Calculate the spot size at wavelength of 1.3 μm and 1.55 μm. 5

5. (a) Derive an expression for external efficiency of LED. 5

   (b) A PN photodiode has a quantum efficiency of 70% for photons of energy 1.52×10^{-19} J. Calculate

   (i) the wavelength at which the diode is operating and

   (ii) the optical power required to achieve a photocurrent of 3 μA when the wavelength of incident photons is that calculated in part (i). 5

6. (a) Explain the characteristics of LED. 5

   (b) What are the causes of attenuation in single mode fiber ? 5

7. (a) Derive an expression for threshold gain coefficient of LASER. 5

   (b) Two compatible multimode SI fibers are joined with a lateral offset of 3 μm, an angular misalignment of the core axes by 3^0, and a small air gap (but negligible end separation). If the core of each fiber has a refractive index of 1.48, a relative refractive index difference of 2%, and a diameter of 100 μm then calculate the total insertion loss at the joint, which may be assumed to comprise the sum of all the misalignment losses. 5

8. Write short notes on any two of the following : 5×2

   (a) Basic principle of solar cell

   (b) Double crucible method

   (c) Avalanche Photo detector

   (d) Electro optic Modulator.