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

Total number of printed pages – 2

B. Tech

PEEC 4302

Fifth Semester Examination – 2013

FIBER OPTICS AND OPTOELECTRONICS DEVICES

BRANCH : ELECTRICAL, ETC, EC

QUESTION CODE : C-363

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) Which wavelength is used in second generation optical system ?
   (b) Define numerical aperture of a fiber.
   (c) When the mean optical power launched into an 8 km length of optical fiber is 120 μW, the mean optical fiber at the output in 3 μW. what is the overall signal attenuation in dB ?
   (d) Differentiate between dispersion shifted and dispersion flattened fiber.
   (e) How is a connector different from splice ?
   (f) Write any two differences between the radiation pattern of a LED and Laser Diode.
   (g) A *p-n* photodiode has a quantum efficiency of 50% at a wavelength of 0.9 μm, calculate its responsivity.
   (h) What is Johnson Noise ? Write an expression for it.
   (i) Distinguish between couplers, isolators and circulator. Give an example where circulator is used.
   (j) What do you mean by Fill factor of a solar cell ?
2. (a) What is a mode ? Differentiate between hybrid modes and pure modes. Show a schematic diagram for distribution of intensity for LP_{32} modes. 5
   (b) A silica optical fiber with a core diameter large enough to be considered by ray theory analysis has a core refractive index of 1.5 and cladding

refractive index of 1.47. Determine (a) the critical angle at the core-cladding interface, (b) NA for the fiber, (c) the acceptance angle in air for the fiber. 5

3. (a) How intermodal dispersion differs from intramodal dispersion ? What are the different types of intramodal dispersion ? 5

   (b) A multimode graded index fiber exhibits total pulse broadening of 0.1 μs over a distance of 15 km. Estimate the maximum possible bandwidth on the link assuming no intersymbol interference and the pulse dispersion per unit length. 5

4. With a neat diagram describe double crucible method for fiber fabrication. Explain how you can control the refractive index of the fiber. 10

5. (a) Draw the schematic diagram for a long wavelength LED using Double heterostructure configuration. 5

   (b) What is an optical cavity ? How is it useful in a Laser device ? 5

6. (a) How does an optical amplifier differ from electronic amplifier ? Give two examples where optical amplifier is used. 5

   (b) A lithium niobate strip waveguide phase modulator designed for operation at a wavelength of 1.3 μm is 2 cm long with a distance between the electrodes of 25 μm. Determine the voltage required to provide a phase change of π radians given that the electro-optic co-efficient for lithium niobate is 30.8×10^{-12} m/V and its refractive index is 2.1 at 1.3 μm. 5

7. (a) State electro-optic effect. Explain transverse electro-optic modulator using a suitable diagram 5

   (b) Explain the principle of operation in a homojunction solar cell. Draw its I-V characteristics. How is a solar cell different from a Photodetector ? 5

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

   (a) APD

   (b) EDFA

   (c) Optical Switching

   (d) Attenuation in optical fiber.