53 (IE 703) FOLI

2014

FIBER OPTICS & LASER INSTRUMENTS

Paper : IE 703

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* What role does internal reflection play in light propagation through an optical fiber ? 3

   (b) A photodiode is constructed with GaAs having the band gap energy of $1{\cdot}43eV$ at temperature of $300K$. What will be the cut-off wavelength for this photodiode ? 5

   (c) Explain the difference between dispersion and bandwidth length product. 4

(d) In what applications single mode fibers are preferred ? 2

(e) Compare the characteristics of LASER and ordinary light in brief. 6

2. (a) Discuss the advantages and disadvantages of the two available optical sources for fiber optics. 5

(b) Explain how the four level LASER scheme is more efficient than three level LASER. 6

(c) Explain the sources of noise in a detector. Which one is easiest to control ? Which one has the least effect on the signal ? 5

(d) Calculate the NA and acceptance angle of a fiber with a core index of 1·93 and a cladding index of 1·87. 4

3. (a) What are the *two* steps of fiber end preparation ? Name the solvents used in removal of fiber coating. 4

(b) Give the NRZ code and Manchester code for the bit sequence 11001110. 4

(c) What is the difference between a splice and a connector ? Specify the sources of loss in a splice and connector. How they are reduced ? 6

(d) A light source with a bandwidth of $50GHz$ is injected into a $1 \cdot 5km$ long fiber. If the pulse injected has a width of $10m/sec$ and the BWL of the fiber is $50KHz\text{-}km$, what is the pulse width at the exit end of the fiber ? 6

4. (a) What are the *three* categories of reflection ? Explain in brief. 6

(b) What are the different terms used to describe the noise and sensitivity of a detector ? 3

(c) What are the differences in characteristics between a PIN and an APD detector ? 6

(d) If an electromagnetic wave is described by the equation $\rightarrow Y = 10 sin(2\pi x - 10\pi t + 30)$. Then determine its wavelength and frequency. 5

5. *(a)* What is the energy of a 400*nm* photon ? 3

(b) What is the *V*-number of an optical fiber ? 2

(c) An optical fiber has the following parameters →

Core R.I. = 1·55

Cladding R.I. = 1·51

Core diameter = 50 μm

If the light is launched into this fiber from a medium of R.I. 1·32 ; find the N.A. and maximum acceptance angle.

It this fiber has to be used at an operating wavelength of 800*nm*, determine the *V*-number and number of modes supported. 8

(d) Differentiate between the reflection hologram and transmission hologram. 7

6. *(a)* Differentiate between glass optical fiber and plastic optical fiber. 7

(b) Describe the working of Fabry-Perot Laser. 7

(c) Write few important applications of optical fiber. 5

(b) What is the function of an intrinsic layer in PIN ? 1

7. (a) Write short notes on : ***(any four)*** 20

(i) Q-Switching

(ii) Mode Locking

(iii) Lasik

(iv) Lidar

(v) Interference

(vi) APD.
