53 (IE 703) FOLI

2018

FIBER OPTICS AND 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 do you mean by 'Numerical Aperture' and 'Acceptance Angle' of a fiber ? Derive the expression for them. 2+6=8

   (b) What are the different advantages of optical fiber over the copper wire system in telecommunication application ? 4

   (c) What is V-number ? What is determined using it ? 4

(d) How is stimulated emission different from spontaneous emission ?

2

(e) What are the purposes served by the cladding of the optical fiber ?

2

2. (a) Describe the process of production of *He-Ne* Laser. 6

(b) What is Holography ? How photography differs from holography ?

2+4=6

(c) What are the advantages of optical sensors compared to conventional electric sensors ? 4

(d) List the advantages and disadvantages of multimode optical fiber.

4

3. (a) Explain with necessary diagram, the process of 'absorption', 'spontaneous emission' and 'stimulated emission' in a two level energy system.

6

(b) How is current measured using optical fiber sensor? Show the arrangement used for measuring current by Faraday rotation. 8

(c) Define the following parameters of a coupler : 6

* Tap loss
* Throughput loss
* Directionality
* Excess loss.

4. (a) Compute the V-parameter and the no. of modes supported by a fiber n_1 (core) = 1·54 and n_2 (cladding) = 1·5 ; core radius 25μm and operating wavelength is 1300nm. 5

(b) What are intrinsic and extrinsic types of fiber optic sensors? Give some examples each of them. 4

(c) What are the advantages and disadvantages of a Laser Doppler Velocimeter? Explain briefly its working principle with a suitable diagram. 6

(d) Describe with diagram the method of measurement of pressure by an optical sensor. 5

5. (a) What is a 'Microbend sensor' ? Discuss the principle of working of Microbend sensor. 2+6=8

(b) Describe *any two* splicing techniques with neat diagram. 8

(c) State the difference between PIN and APD photo detectors. 4

6. (a) Differentiate between LIDAR and RADAR along with their applications. 8

(b) Show with a neat diagram, how Laser can be used for measurement of distance. 6

(c) How the Lasers are classified depending on the nature of the active media ? Explain each of the categories. 6

7. (a) What is irradiance ? How is it calculated ? 3

(b) List the types of Lasers used in brain tumor treatment. 3

(c) Discuss about resonator configuration of a Laser setup. 8

(d) What are the energies in *eV* of light at wavelengths 850, 1310 and 1510*nm*? 3

(e) Describe diffraction, interference and polarization. 3

8. Write short notes on : ***(any four)*** 5×4=20

(a) Q-Switching

(b) Mach-Zehnder interferometric sensor

(c) Population inversion

(d) Rayleigh scattering

(e) Skew rays

(f) Quantum efficiency.