**53 (IE 703) FOLI**

**2017**

# 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)* A ray of light travelling in air strikes a particular transparent plate defining an angle of 30° w.r.t. the incoming ray and plate surface. If the transmitted and reflected ray makes an angle of 85° with each other, determine the R.I. of the transparent plate. Also find the critical angle in this case. 6

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

(c) A fiber has $30mW$ of light power injected into it. Of this $27{\cdot}9mW$ exits the opposite end of the fiber. This exiting light from the fiber fall upon a detector with a light sensitive area of $5cm^2$. Now determine the irradiance. 5

(d) What is the difference between LIDAR and RADAR? Draw the block diagram of a typical LIDAR system. 6

(e) How does a PIN detector differ from APD? 3

3. (a) With the help of an energy diagram, explain how the four level LASER scheme is more efficient than three level LASER system. 7

(b) Calculate the frequency of stimulating photons if an atom is stimulated from the state of $1\times10^{-34}J$ to an excited level of $7{\cdot}62\times10^{-34}J$. 4

(c) State some of the important features of Nd-YAG LASER. 4

(d) Explain about the operation of the two techniques : Q-switching and Mode locking in LASER system. 5

4. *(a)* Discuss the various resonator configurations of a LASER setup. 8

*(b)* Generalize the properties of LASER. 5

*(c)* Summerise the merits and demerits of LASER welding. 5

*(d)* Outline some areas of LIDAR applications. 2

5. *(a)* Describe with a neat diagram about LASER Doppler velocimetry for fluid velocity measurement. 8

*(b)* Draw and explain the Mach-Zehnder interferometric sensor arrangement. 10

*(c)* Calculate the quantum efficiency of an APD that produces 10 electrons for every one incident photon. 2

6. *(a)* Outline the differences between holography and photography. 7

*(b)* Explain about three scientific applications of holography. 6

*(c)* Differentiate between the reflection hologram and transmission hologram. 5

(d) What are the requirements of LASER instruments for surgery? 2

7. Write technical notes on : ***(any four)*** 5×4=20

(a) Material dispersion

(b) Optical fluid level detector

(c) Fabry Perot LASER

(d) Extrinsic Loss in fiber

(e) Gas LASER.

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