Printed Pages:02 **Sub Code: EOE 043/ NOE 043**

Paper Id: 199227 **Roll No.** | | | | | | | | | | |

B. TECH.
(SEM IV) THEORY EXAMINATION 2017-18
LASER SYSTEMS AND APPLICATIONS

Time: 3 Hours ***Total Marks: 100***

Note: 1. Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. 2 x 10 = 20

a. What do you mean by modified and unmodified radiations?

b. Explain the physical significance of wave function.

c. What are the characteristics of laser beam?

d. Describe the factor which causes losses in a laser.

e. State two differences between stimulated and spontaneous emission.

f. Define laser gain and loop gain.

g. What are pulsed wave lasers?

h. What is the role of helium in He-Ne laser?

i. State the application of laser in optical communication.

j. State the difference between photography and holography.

SECTION B

2. Attempt any *three* of the following: 10 x 3 = 30

a. What is a mode-locked laser? Explain Active and Passive mode locking.

b. Derive Schrodinger time-dependent and time-independent wave equations.

c. Discuss the working of Excimer laser. And state its properties and applications.

d. Explain the construction and working of Nd-YAG solid state laser with applications.

e. What is dye laser? Explain its construction and working mechanism. State few applications of dye laser.

SECTION C

3. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is Compton Effect? Derive an expression for Compton Shift.

(b) (i) Calculate the average energy of a Planck's oscillator of frequency 5.6 x 10^{12} cycles per second at 57°C.

(ii) A particle is moving in one dimensional potential box (of infinite height) of width 25Å. Calculate the probability of finding the particle within an interval of 5 Å at the centre of the box when it is in its state of least energy.

4. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is a Q-switched laser? Explain various techniques used in Q- switching.

(b) Calculate (a) velocity of Bohr's first orbit. Also find (b) radius, (c) total energy, (d) time period and (e) frequency of nth orbit electron.

5. Attempt any *one* part of the following: 10 x 1 = 10

(a) Explain three level laser systems and derive rate equations for various levels in three level laser systems.

(b) What do you understand by optical cavity? Explain various types of optical cavities with suitable diagram.

6. Attempt any *one* part of the following: 10 x 1 = 10

(a) What are molecular lasers? Describe construction and working of CO_2 lasers.

(b) Explain construction and working of argon ion laser. Write down different characteristics and applications of the ion lasers.

7. Attempt any *one* part of the following: 10 x 1 = 10

(a) What is holography? How it different from photography. Explain construction and reconstruction of hologram.

(b) Explain the principle and operation of LIDAR.

Physical Constants

Rest mass of electron	mo	= 9.1 x 10-31 kg
Rest mass of Proton	mp	= 1.67 x 10-27 kg
Speed of light	c	= 3 x 108 m/s
Planck Constant	h	= 6.63 x 10-34 J-s
Charge on electron	e	= 1.6 x 10-19 C
Boltzmann Constant	k	=1.38 x 10-23 J K-1