

B. Tech
(SEM-III) THEORY EXAMINATION 2017-18
LASER SYSTEMS AND APPLICATIONS

Time: 3Hours

Max. Marks: 70

Note: Attempt all Sections. Assume missing data, if any.

SECTION A1. Attempt *all* questions in brief:

2 x 7 = 14

- a. What do you mean by Polarization of X-ray?
- b. What is tunnel effect?
- c. Why spontaneous emission of radiation is incoherent?
- d. What is function of optical cavities in a laser?
- e. What do you mean by population inversion?
- f. What are characteristics properties of argon ion laser?
- g. Can we get hologram with ordinary light?

SECTION B2. Attempt any *three* of the following:

3 X 7 = 21

- a. What do you mean by black body? Explain features of black body spectrum.
- b. What are pumping techniques? Discuss different types of pumping techniques in different types of laser.
- c. What is Q switched laser? Discuss various methods.
- d. With necessary diagram explain construction and working of Nd:YAG laser.
- e. Explain laser welding and its advantages over conventional welding techniques. Briefly explain, how laser are useful in drilling and cutting?

SECTION C3. Attempt any *one* part of the following:

1 X 7 = 7

- (a) Explain Bohr theory of hydrogen atom. If an electron transit from third orbit to first orbit. Find the wavelength of electron in hydrogen atom.
- (b) Solve Schrodinger wave equation to find Eigen value and Eigen function for a particle in an infinite potential well.

4. Attempt any *one* part of the following:

1 X 7 = 7

- (a) What are important features of stimulated emission of radiation? Discuss essential conditions for producing laser beam. Find population ratio between two energy states in Ruby laser producing a laser light of wavelength 7000\AA at 330K .
- (b) What do you know about threshold condition for laser oscillation? Find an expression for threshold condition for lasing.

5. Attempt any *one* part of the following:

1 X 7 = 7

- (a) What are main components of laser? Discuss each component in detail.
- (b) With the help of suitable diagram describe three level laser actions. If population ratio of two states is 3×10^{-40} in He-Ne laser, produces light of wavelength 6328\AA . Find temperature of energy states.

6. Attempt any *one* part of the following:

1 X 7 = 7

- (a) What are molecular gas lasers? Describe construction, working and application of carbon dioxide laser.
- (b) Explain the working of semiconductor laser. Differentiate between Homojunction and Heterojunction laser.

7. Attempt any *one* part of the following:

1 X 7 = 7

- (a) What is LIDAR? Discuss its components and their role. How atmospheric pollutants are measured using LIDAR?
- (b) Discuss how the laser can be used in optical communication.

Physical Constants

Rest mass of electron
Rest mass of Proton
Speed of light
Planck Constant
Charge on electron
Boltzmann Constant

$m_e = 9.1 \times 10^{-31} \text{ kg}$
 $m_p = 1.67 \times 10^{-27} \text{ kg}$
 $c = 3 \times 10^8 \text{ m/s}$
 $h = 6.63 \times 10^{-34} \text{ J-s}$
 $e = 1.6 \times 10^{-19} \text{ C}$
 $k = 1.38 \times 10^{-23} \text{ J K}^{-1}$