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

Time: 3Hours

Max. Marks: 100

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

SECTION A

1. Attempt all questions in brief. 2 x10 = 20

- a. What do you mean by de-Broglie hypothesis?
- b. Explain characteristics of wave function.
- c. Specify the characteristics of laser beam.
- d. Show that population inversion is a condition of negative temperature.
- e. Show that lasing is not possible in two level laser.
- f. Discuss the process of stimulated emission of radiation.
- g. How is pumping is done in solid state laser?
- h. Why dye laser is tunable?
- i. What is LIDAR?
- j. Why is pulse laser usually used for material processing?

SECTION B

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

- a. Establish time dependent Schrodinger wave equation. What do you mean by Eigen value and Eigen function.
- b. Discuss the working of resonator in laser system. Classify resonators and working of one of them.
- c. Obtain the condition for laser action in three level systems. Give an example of a real three level laser.
- d. What are continuous pulse laser? Discuss construction and working of He- Ne laser.
- e. Discuss, how the laser can be used in metrology?

SECTION C

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

- (a) Derive an expression for Compton shift. A Photon recoils back after striking an electron in rest. What is the change in wavelength of photon?
- (b) Find the expression of de-Broglie wavelength in terms if temperature. Find de-Broglie wavelength of a proton, which is moving with a velocity 2×10^8 m/sec.

4. Attempt any *one* part of the following: 10 x 1 = 10
- (a) What is pumping and discuss its various methods. Find the intensity of laser beam of 100mW power and having a diameter of 1mm. Assume that intensity to be uniform.
- (b) What are main components of laser? Discuss their necessity in the laser action.
5. Attempt any *one* part of the following: 10 x 1 = 10
- (a) What do you mean by laser gain? Obtain the condition of threshold gain.
- (b) What do you mean by Q- switching? Describe the various method of Q- Switching in brief.
6. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Discuss the features, lasing transition, operation of Nd: YAG laser.
- (b) What are excimer laser. Discuss its properties and applications.
7. Attempt any *one* part of the following: 10 x 1 = 10
- (a) Discuss the application of laser in optical communication.
- (b) Explain the application of laser in medical science.

Physical Constants

Rest mass of electron	m_0	$= 9.1 \times 10^{-31} \text{ kg}$
Rest mass of Proton	m_p	$= 1.67 \times 10^{-27} \text{ kg}$
Speed of light	c	$= 3 \times 10^8 \text{ m/s}$
Planck Constant	h	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	e	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann Constant	k	$= 1.38 \times 10^{-23} \text{ J K}^{-1}$