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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 A

1.   **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 invertion?

   f.   What are characteristics properties of argon ion laser?

   g.   Can we get hologram with ordinary light?

SECTION B

2.   **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 puming 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 C

3.   **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 7000Å 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 6328Å. 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	m_o	$= 9.1 \times 10^{-31}$ kg
Rest mass of Proton	m_p	$= 1.67 \times 10^{-27}$ kg
Speed of light	c	$= 3 \times 10^{8}$ m/s
Planck Constant	h	$= 6.63 \times 10^{-34}$ J-s
Charge on electron	e	$= 1.6 \times 10^{-19}$ C
Boltzmann Constant	k	$= 1.38 \times 10^{-23}$ J K^{-1}