

(Following Paper ID and Roll No. to be filled in your
Answer Books)

Paper ID : 2289415

Roll No.

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B.TECH

Regular Theory Examination (Odd Sem - III), 2016-17
LASER SYSTEM AND APPLICATIONS

Time : 3 Hours

Max. Marks : 100

**Note : Attempt all sections. If require any missing data;
then choose suitably.**

Section - A

1. Attempt all questions in brief. (10×2=20)
- What do understand by Planck's Hypothesis?
 - Describe wave particle duality in short.
 - Explain the physical significance of wave function.
 - How is metastable state essential to achieve population inversion?
 - Describe the factors which cause losses in a laser.
 - Find the intensity of a laser beam of 100mW power and having a diameter of 1.3mm. Assume the intensity to be uniform.

- g) What is an active medium?
- h) What are Dye Lasers?
- i) Write few applications of Ruby laser.
- j) What is hole-burning in laser gain curve?

Section - B

2. Attempt any three of the following: (3×10=30)

- a) What is Compton Effect? Derive an expression for Compton shift. A photon of energy 1.02 MeV is scattered through 60° by a free electron. Calculate the energy of the photon and the electron after interaction.
- b) What are the Einstein's coefficients? Establish a relation between them.
- c) Why does a two-level laser not have any physical significance? Explain working of three and four level laser systems.
- d) What are ionic lasers? Explain the construction and working of Argon ion laser.
- e) Write a note on application of laser in medicine and surgery.

Section - C

3. Attempt any one part of the following: (1×10=10)

- a) By using Heisenberg's uncertainty principle, show that an electron cannot exist inside the nucleus but proton can exist.

- b) Describe Davisson and Germer's electron diffraction experiment to demonstrate the wave character of electron.
4. Attempt any one part of the following : (1×10=10)
- a) What is the concept of coherence in laser? Derive a relation between coherence length and line width.
- b) What is an optical resonator and explain its various configurations.
5. Attempt any one part of the following: (1×10=10)
- a) What do you mean by loop gain? If active medium gain in laser is 1.03 with length 30 cm. The loss coefficient is $\alpha = 1.35 \times 10^{-4} \text{ cm}^{-1}$. The reflection coefficients of the mirrors are 0.99 and 0.94 respectively. Calculate its loss factor, loop gain and gain coefficient.
- b) What do you mean by Q-switching? Describe various methods of Q-switching in brief.
6. Attempt any one part of the following: (1×10=10)
- a) Describe the construction and working of He-Ne laser. Compare it Ruby Laser.
- b) Discuss the features, lasing transitions, operations of Nd^{3+} : YAG laser.

7. Attempt any one part of the following: ($1 \times 10 = 10$)

- a) What do you mean by material processing? What are the various changes that can take place during material processing?
- b) Discuss, how Laser can be used in Metrology?

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's Constant	h	$= 6.63 \times 10^{-34} \text{ J-s}$
Charge on electron	e	$= 1.6 \times 10^{-19} \text{ C}$
Boltzmann's Constant	k	$= 1.38 \times 10^{-23} \text{ J K}^{-1}$

