



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

PAPER ID : 0929 Roll No. 

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**B.Tech.**

(SEM. III) ODD SEMESTER THEORY EXAMINATION  
2010-11

**LASER SYSTEM AND APPLICATIONS**

*Time : 3 Hours*

*Total Marks : 100*

**Note :** (1) Attempt all questions.

(2) All questions carry equal marks.

1. Attempt any two of the following : (2×10=20)
- (a) Explain the physical significance of the wave function. Derive Schrodinger's time dependent wave equation starting from Schrodinger's time independent wave equation.
- (b) What is pumping? How can it help in achieving population inversion? Differentiate between optical pumping and electrical pumping scheme.
- (c) What are semi conductor LASER? Discuss the applications of semi conductor LASER.

Attempt any two of the following :  $(2 \times 10 = 20)$

- (a) A spherical sodium lamp of radius  $\frac{2}{\pi}$  cm and power 50 watts is emitting yellow lines between 589 nm and 589.6 nm. If the power contained in 589 nm of spectral width of 0.1 nm, is 25 watts, calculate the brightness of lamp. Also calculate its spectral brightness.
- (b) What do you mean by coherence ? Explain different types of coherence with the help of suitable diagrams. The coherence length of a light source is  $2.5 \times 10^{-2}$  m and its wavelength is  $5500 \text{ \AA}$ , calculate :
- Frequency
  - Coherence time.
- (c) Show that a two level pumping scheme has no practical significance for lasing. Derive the expression for threshold population in a 3-level laser system.

3. Attempt any two of the following :  $(2 \times 10 = 20)$

- (a) What do you mean by modes in a resonator ? Derive an expression for frequency difference between successive modes for a cavity of length L.
- (b) (i) What is gain in lasers ? Obtain the condition for threshold gain.
- (ii) What are optical cavities ? How they are useful in laser action ?
- (c) Derive an expression for Einstein's coefficient of stimulated and spontaneous emission.

4. Attempt any two of the following :  $(2 \times 10 = 20)$

- (a) Explain construction and working of He-Ne laser.
- (b) What do you mean by excimer ? Discuss excimer laser.
- (c) Differentiate between homogeneous and heterojunction PN Junction laser. Calculate the wavelength of emission of GaAs semiconductor laser whose band gap energy is 1.44 eV.

5. Attempt any two of the following :  $(2 \times 10 = 20)$

- (a) Describe various methods of Q switching. How it is helpful in generating laser pulses ?
- (b) Explain the following :
- Active mode locking
  - Passive mode locking.
- (c) What is holography ? Explain recording and reconstruction of a hologram.