Printed Pages : 2   **Roll No.** ☐☐☐☐☐☐☐☐☐☐☐   **NOE043**

B. TECH.
THEORY EXAMINATION (SEM–IV) 2016-17
LASER SYSTEMS AND APPLICATIONS

Time : 3 Hours   *Max. Marks : 100*

Note : *Be precise in your answer. In case of numerical problem assume data wherever not provided.*

SECTION – A

1. **Attempt all parts of the following question:**   **10 x 2 = 20**
   - **a)** Find the de-Broglie wavelength for an electron of energy V eV.
   - **b)** What was the objective of conducting Davisson-Germer experiment?
   - **c)** What do you mean by unmodified radiation in Compton scattering?
   - **d)** What do you mean by stimulated emission of radiation?
   - **e)** What is the role of optical cavity in a laser?
   - **f)** Why a two level pumping scheme is not suitable for lasing?
   - **g)** What is spiking in ruby laser?
   - **h)** What is gain medium in excimer lasers?
   - **i)** How Q switching is helpful in generating laser pulses?
   - **j)** Explain important characteristics of a hologram.

SECTION – B

2. **Attempt any five parts of the following question:**   **5 x 10 = 50**
   - **a)** Discuss significance of Heisenberg's uncertainty principle in relation to microscopic and macroscopic bodies. Use Heisenberg's uncertainty principle to find binding energy of an electron in an atom.
   - **b)** Describe the main components of laser and explain the principle involved to obtain a laser beam. Calculate the coherence length of a laser beam for which the band width Δv = 3000 Hz. Speed of light $c = 3 \times 10^8$ m / s.
   - **c)** What are the advantages of four level lasers over three level lasers? Derive an expression for threshold pumping power required to start laser action in three level laser systems.
   - **d)** Describe different types of lasers on the basis of medium. Discuss their merits and demerits.
   - **e)** Describe the construction and working of CO_2 laser. A gas laser is generating a laser beam of 4 mW power. Calculate the number of photons emitted by the laser. The wave length of the emitted radiation is 680 nm.
   - **f)** What is mode locking? Explain how mode locking is used to produce short laser pulses.
   - **g)** What are dye lasers? Explain the laser action of dye laser.
   - **h)** What are the applications of lasers in LIDAR? Explain principle of operation and applications of LIDAR.

SECTION – C

Attempt any two questions of the following: **2 x 15 = 30**

3. Write down Schrödinger's wave equation for a particle in a box. Solve it to obtain Eigen functions and show that the Eigen values are discrete. An electron is confined to a one-dimensional box of side 1 A^0. Obtain the first two Eigen values of the electron in eV.

4. What are solid state lasers? Describe construction, working and application of alexandrite lasers. What are its advantages over neodymium lasers?

5. (i) How lasers are useful in drilling and cutting. Discuss applications of lasers in melting.

(ii) What are the characteristics of lasers required for precise measurement of length? Explain how this measurement is achieved.