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

Paper ID : 199409   Roll No.

B.TECH.

Theory Examination (Semester-IV) 2015-16

LASER SYSTEM & APPLICATIONS

Time : 3 Hours   *Max. Marks : 100*

Section-A

Q1. **Attempt all parts. All parts carry equal marks. Write answer of each part in short.** (2×10=20)

(a) Write the hypothesis of Planck related to quantum theory.

(b) What are the characteristics of wave function?

(c) How is spontaneous emission different from induced emission?

(d) Why is metastable state essential to achieve population inversion?

(e)   What do you understand by loop gain?

(f)   Explain why a two-level laser makes no practical importance.

(g)   Write a few applications of liquid dye laser.

(h)   What are molecular gas lasers?

(i)   Which lasers are employed in industry and why?

(j)   What are the applications of LIDAR?

Section-B

Q2. **Attempt any five parts from the following.**   (10×5=50)

(a)   Deduce an expression for the energy and wave function of a particle confined in a one-dimensional box of length L.

(b)   Explain the continuous wave and pulsed lasers with diagrams.

(c)   Derive an expression between coherence length and line width. The coherence length of a light source is 2.5 x 10^{-20} m and its wavelength is 5500A. Calculate (i) Frequency and (ii) Coherence time.

(d)   What are the applications of producing short pulses of light? Calculate the uncertainty in the position of a dust particle with mass equal to 1 mg if uncertainty in its velocity is 5.5 x 10^{-20} m/s.

(e)   Describe how the medium is excited in ionic lasers. Explain the operation of Argon ion (Ar+) laser with suitable energy level diagram.

(f)   Explain Neodymium (Nd) lasers. Describe the construction and working of Nd^{3+}-YAG laser.

(g)   What is LIDAR? Explain the principle of operation of a LIDAR.

(h)   Describe the working of three-level and four-level laser systems and hence conclude the superiority of either laser system.

Section-C

Note: Attempt any two questions from this section.
(15×2=30)

Q3. (a)   What is Compton effect? Explain and deduce an expression for Compton shift.

(b)   Describe the working of CO_2 laser.

(c) Write short note on applications of laser in ophthalmology.

Q4. (a) Describe the various configurations of optical cavities.

(b) Write a note on excimer laser drawing its energy level diagram.

(c) Explain the components of laser system.

Q5. (a) Derive a relation between Einstein's coefficients.

(b) What do you mean by Q-switching and describe its various methods?

(c) Write short notes on-

(i) Laser in dermatology

(ii) Laser in dentistry