AU–304

M.Sc. Semester—II (CBCS Scheme) Examination

PHYSICS

(2-PHY-4 (ii) : Laser Fundamentals and Applications)

Time : Three Hours] [Maximum Marks : 80

Note :— All questions are compulsory and carry equal marks.

1. (A) Explain the terms, spontaneous emission and stimulated emission with example. 6

   (B) Explain Einstein's coefficients for spontaneous emission and stimulated emission with the help of two level atom. 6

   (C) What is population inversion ? How is it achieved by pumping process ? 4

OR

   (P) Explain the term Line Broadening. 5

   (Q) Derive an expression for gain of a medium. 5

   (R) Write a note on Doppler broadening. 6

2. (A) How is population inversion achieved by optical pumping ? 6

   (B) Compare the pumping requirement of three level laser with four level . 6

   (C) Discuss the threshold condition for three level laser system. 4

OR

   (P) Explain the conditions for obtaining steady state oscillation. 6

   (Q) Explain the mechanism of four level laser system. 6

   (R) What is gain saturation ? 4

3. (A) Explain the modes in laser cavity. 4

   (B) Discuss the longitudinal mode and transverse mode. 4

   (C) What do you mean by Hole Burning ? Explain spectral hole burning and spatial hole burning. 8

OR

   (P) What are the properties associated with Gaussian beam ? 6

   (Q) What are ABCD matrices ? Derive the matrix for translation over a distance D. 4

   (R) Explain stable curved mirrors cavities. 6

4. (A) Explain the types of Q-Switching. What are active and passive Q-Switchings ? 8

(B) What is mode locking ? Explain the techniques for producing mode locking. 8

OR

(P) Derive an expression for peak power, total energy and pulse duration for Q-switched cavity. 10

(Q) Discuss the applications of nanosecond pulse. 6

5. (A) Draw energy level diagram of CO_2 laser and describe the pumping scheme and give its applications. 8

(B) Give the construction and working of Nd-YAG Laser. State its applications. 8

OR

(P) Discuss the working principle of semi-conductor laser with the help of neat diagram. What are the advantages of semiconductor laser ? 8

(Q) Explain the construction and working of Ar-ion Laser. State its applications. 8