(i) Printed Pages: 3 Roll No. .....

(ii) Questions : 7 Sub. Code : 0 3 4 8

Exam. Code : 0 0 0 4

B.A./B.Sc. (General) 4th Semester

1059

PHYSICS

Paper : B (Optics and Lazer-II)

Time Allowed : Three Hours] **[Maximum Marks : 22**

Note :— Attempt **five** questions in all by selecting **two** questions each from Section I and II. Question No. **7** is compulsory. Use of non-programmable calculator is allowed.

SECTION—I

1. (a) Giving an account of spontaneous and stimulated emission, derive relations between Einstein coefficients. Explain why high frequency lasers are difficult to build and operate. 3

   (b) Give a qualitative account of Collisional broadening, Doppler broadening and natural broadening. 1½

2. (a) Explain three and four level pumping schemes by drawing necessary diagrams. Also explain which one is better and why. 3

   (b) Discuss elementary theory of optical cavity. 1½

3. (a) What is spatial and temporal coherence ? Derive necessary relations. 3

(b) Estimate the Doppler Broadening of 706.52 nm line of Helium, when the gas is at 1000 K. The root mean square velocity of a gas molecule is given by $v_{rms} = \sqrt{\frac{3RT}{M}}$ where R is gas constant, T is temperature and M is molecular weight. 1½

SECTION—II

4. (a) Explain the construction and working of Ruby laser by drawing suitable energy diagram. Also explain what is spiking ? 3

(b) What is the difference between holography and photography ? Explain. 1½

5. (a) Explain working Dye laser by drawing necessary diagram in detail. 2½

(b) Give a detailed account of Intermodal and Intramodal dispersion. 2

6. (a) What are Step Index (single mode and multi mode) and Graded Index fibre ? Also give an account of their specific uses. 3

(b) A fibre has normalized frequency V = 26.6 and the operating wavelength is 1300 nm. If the radius of the fibre core is 25 μm. Compute the numerical aperture. 1½

SECTION—III

7. Attempt any **eight** parts :

(a) What is the cause of high coherence in LASERS ? Explain.

(b) What is the role of Nitrogen and Helium in carbon-dioxide laser ?

(c) What is Luminescence ?

(d) What is Macrobending ?

(e) Define maximum acceptance angle of an optical fibre.

(f) Why cladding is necessary in optical fibre ?

(g) Why there cannot be a perfectly monochromatic source ?

(h) Which type of fibre has highest bandwidth ?

(i) Give examples of Homogeneous and Non-homogeneous broadening.

(j) The sodium yellow light of wavelength 5893 Å is a doublet of 6 Å width. Find non-monochromaticity.

$8 \times \frac{1}{2} = 4$