[This question paper contains 4 printed pages.]

**1012** *Your Roll No.* .....

**B.Sc. (Hons.) / II** **C**

ELECTRONIC SCIENCE – Paper 2.5 (XII)

(Modern Optics and Opto-electronics)

*Time : 3 Hours* *Maximum Marks : 38*

*(Write your Roll No. on the top immediately on receipt of this question paper.)*

*Attempt* **Five** *questions in all, including Question No.* **1,** *which is compulsory.*

1. Attempt any **five** of the following :

   (a) The orange Kr line ($\lambda = 6058$ Å) has a coherence length of ~20 cm. Calculate the line width.

   (b) What is an etalon ? Where and why it is used ?

   (c) A grating is ruled over a width of 10 cm, and the number of lines on the grating is 5000 lines/cm. Find the smallest wavelength difference that can be resolved in the region of 5000 Å in the 1st order.

   (d) What is the advantage of four level laser over three level laser system ?

P.T.O.

(e) What are non reflecting films ? Explain the principle involved.

(f) A wire of 0.1 cm diameter is placed in front of an illuminated narrow slit. A screen is placed 6 m away from the source. Calculate the fringe width in the geometrical shadow if the slit is illuminated by a light of wavelength 5460 Å. (2×5)

2. (a) Explain with the help of Raydiagram the construction and working of Ramsden's Eye-piece. Why is this eyepiece called a positive eye piece. (3)

(b) What do you understand by position and shape factor of a lens ? How are the two related for minimum spherical aberration. (1½)

(c) What do you mean by chromatic aberration ? Derive the condition for achromatism of two lenses separated by a distance. (2½)

3. (a) Obtain an expression for the intensity of transmitted light in case of Febry Perot interferometer and explain the effect of reflectivity on intensity. (3)

(b) In a biprism experiment the micrometer reading for zero order and tenth order fringes is 1.25 mm

and 2.37 mm respectively when a light of $\lambda = 5.9\times10^{-5}$ cm is used. What will be the position of zero order and tenth order fringe, if $\lambda$ is changed to $7.5\times10^{-5}$ cm. (2)

(c) What is 'principle of Reversibility' ? Using this prove that an abrupt phase change of $\pi$ occurs when light gets reflected by denser medium. (2)

4. (a) What is a zone plate ? Derive the formula for the focal length of a zone plate and explain its multiple focii. (3½)

(b) Using Fresnel Kirchoff diffraction formula. Derive expression for the intensity due to a circular aperture and explain the diffraction pattern. (3½)

5. (a) Give a stepwise method for obtaining Holographic photograph. (3)

(b) Give an experimental method for the production of elliptically polarised light. (3)

(c) Calculate the thickness of $\lambda/4$ plate. Given $\mu_e = 1.553$, $\mu_0 = 1.544$ and $\lambda = 6000$ Å. (1)

P.T.O.

6. (a) What is spatial frequency filtering? Give the configuration of Optical system for spatial frequency filtering. (3)

(b) Write down the laser rate equation in 3 level laser system and hence deduce the expression for population inversion. (3)

(c) Give the dimensions of Einstein A and B coefficients. (1)

7. (a) Obtain the transmission coefficient when a plane em wave is incident obliquely at a plane interface between two dielectric media with electric vector perpendicular to the incident plane. (4)

(b) Describe the construction of a multimode graded index fibre and derive an expression for pulse dispersion. (3)