

Day : Monday  
Date : 06/11/2017

W-2017-0575

Time: 11.00 A.M. TO 02.00 PM  
Max. Marks: 60

**N. B.:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the right indicate **FULL** marks.
- 3) Draw diagrams **WHEREVER** necessary.
- 4) Use of calculator and log table is allowed.

**Q.1** Answer any **TWO** of the following: (12)

- a) Draw ray diagram of Ramsden's eyepiece. Explain its working and show principal points and focal points.
- b) i) A parallel beam of light of wavelength  $5890\text{\AA}$  is incident on a thin film of refractive index 1.5, such that the angle of refraction into the film is  $60^\circ$ . Calculate the smallest thickness of the film which will make it appear dark by reflection.  
ii) Newton's rings are formed between plane glass plate and plano-convex lens of radius 60 cm. If diameter of 3<sup>rd</sup> bright ring is 0.0018 m and that of 23<sup>rd</sup> bright ring is 0.005 m, calculate wavelength of light.
- c) Explain the working of He-Ne Laser.

**Q.2** Answer any **TWO** of the following: (12)

- a) What is a Zone plate? Derive an expression for its focal length and compare its performance with a converging lens.
- b) Derive lens maker's formula for a thin lens.
- c) Two thin converging lenses of focal lengths 15 cm and 20 cm are co-axially 10 cm apart. An object is placed at a distance of 15 cm from the first lens. Find:
  - i) the position of focal points
  - ii) the position of principal points
  - iii) the position of the image

**Q.3** Answer any **TWO** of the following: (12)

- a) What is retardation plate? Explain types of retardation plates.
- b) Prove that for a combination of two thin lenses of focal lengths  $f_1$  and  $f_2$  separated by a distance  $x$ , the focal length of the combination is given by

$$\frac{1}{f} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{x}{f_1 f_2}$$

- c) Give theory of plane transmission grating and derive the intensity equation

$$I = I_0 \left( \frac{\sin \alpha}{\alpha} \right)^2 \frac{\sin^2 (N\beta)}{\sin^2 \beta}$$

**Q.4** Answer any **THREE** of the following: (12)

- a) State and explain Brewster's Law.
- b) Explain optical pumping and stimulated emission of radiation for Laser.
- c) The lenses in Huygen's eye-piece have focal lengths of 2cm and 6 cm. Find the distance between them and also sketch the cardinal points.
- d) Draw a ray diagram to show image formation in a compound microscope. Derive an expression for its magnifying power.

**Q.5** Answer any **FOUR** of the following: (12)

- a) Draw ray diagram of simple microscope and state the formula for maximum MP.
- b) State three points of difference between interference and diffraction.
- c) Explain the determination of the refractive index of a liquid using Newton's rings.
- d) Explain polarization by double refraction.
- e) Give three points of difference between positive and negative crystal.
- f) Explain in brief types of diffraction.

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