BACHELOR OF SCIENCE EXAMINATION, 2019

(2<sup>nd</sup> Year, 1<sup>st</sup> Semester)

PHYSICS (Subsidiary)

Paper: SO6

**Time: 2 Hours**  **Full Marks: 50**

Answer any *four* questions

1. a) State and explain Huygen's Principle for the propagation of light waves.
   b) With the help of this principle deduce the laws of reflection and refraction of a plane wave at a plane surface.

$$4\frac{1}{2} + (4 + 4)$$

2. a) Explain the formation of interference fringes by Fresnel's biprism with a monochromatic source
   b) Calculate the displacement of fringes when a thin transparent sheet is introduced in the path of one of the interfering beams.
   c) When a thin sheet of transparent material of thickness $7.2 \times 10^{-4}$ cm is introduced in the path of one of the interfering beams, the central fringe shifts to a position occupied by the sixth fringe. If $\lambda = 6000$Å, find the refractive index of the sheet.

$$4\frac{1}{2} + 4 + 4$$

3. a) State and explain the conditions for the production of sustained interference fringes.
   b) Consider two coherent sources of same frequency and of intensities I and 2I. Find the ratio of maximum intensity to minimum intensity in their interference pattern.
   c) What do you mean by coherent sources?

$$5 + 5 + 2\frac{1}{2}$$

4. a) Explain the formation of Newton's ring. Show that the diameters of bright rings in a newton's experiment when viewed in reflected light are proportional to the square roots of odd natural numbers.
   b) In a Newton's ring experiment, the diameters of the 4<sup>th</sup> and 12<sup>th</sup> dark rings are 0.40 cm and 0.70 cm, respectively. Find the diameter of the 20<sup>th</sup> dark ring.

$$8\frac{1}{2} + 4$$

5. a) What is grating element? Show that in a diffraction grating with grating element $1.5 \times 10^{-6}$ m and light of wavelength 550 nm, the third and higher order principal maxima are not visible.
   b) What is Brewster's law? Show that when a ray is incident at the Brewster's angle, the reflected ray is perpendicular to the refracted ray.
   c) The critical angle of light in a certain substance is 45°. What is the polarizing angle?

$$\left(1\frac{1}{2}+3\right) + (2 + 4) + 2$$

6. a) What do you understand by double refraction? What are ordinary and extra-ordinary rays?
   b) Explain how Nicol prism can be used as a polarizer and as analyser.
   c) State Malus's Law. Two Nicol prisms have parallel polarizing direction so that the intensity of transmitted light ia maximum. Through what angle must either nicol be turned if the intensity is to drop by one-fourth of its maximum value?

$$(2 + 2) + 4\frac{1}{2} + (2 + 2)$$