2021

Time : 3 hours

Full Marks : ~~100~~ 75

Pass Marks : ~~45~~ 33

Candidates are required to give their answers in their own words as far as practicable.

The questions are of equal value.

*Answer any **five** questions, selecting at least **one** from each Group. Q. No. 1 is compulsory.*

1. Select the correct answer of the following questions :

   (a) A quarter wave plate introduces a phase shift of :

   (i) $\frac{\pi}{6}$

   (ii) $\frac{\pi}{2}$

   (iii) $\frac{\pi}{4}$

   (iv) $\frac{\pi}{3}$

(b) Substances which rotate the plane of polarisation are known as :

(i) Optically inactive substances

(ii) Optically active substances

(iii) Optically reproductive substances

(iv) Optically polarised substances

(c) S. I. unit of resolving power is :

(i) m^{-1}

(ii) m^{-2}

(iii) s^{-1}

(iv) Unitless

(d) The working of Nicol Prism is based on the phenomena of :

(i) Refraction

(ii) Reflection

(iii) Diffraction

(iv) Double refraction

(e) The resolving power of a telescope is directly proportional to :

(i) Frequency of the light used

(ii) The wavelength of the light used

(iii) Square of the frequency of light used

(iv) Amplitude of the light used

(f) The pumping source in He-Ne laser is _____ in nature.

(i) Optical

(ii) Electrical

(iii) Chemical

(iv) Mechanical

(g) When two mirrors of Michelson interferometer are exactly perpendicular, fringes will be :

(i) Circular

(ii) Straight lines

(iii) Parabolic

(iv) Hyperbolic

(h) If υ_o is speed of ordinary ray and υ_e is speed of extraordinary ray, then :

(i) υ_e may be greater than υ_o

(ii) υ_e may be less than υ_o

(iii) υ_e may be equal to υ_o

(iv) All of these

(i) In diffraction pattern of a circular disc, the central fringe is :

(i) Dark

(ii) Bright

(iii) Coloured

(iv) Fringe is not formed

(j) Colour of thin film is due to :

(i) Interference

(ii) Diffraction

(iii) Polarisation

(iv) All of these

(k) Maxwell stress tensor is a symmetric tensor of order :

(i) One

(ii) Two

(iii) Three

(iv) Four

(l) If an electromagnetic wave of intensity I is incident normally on a mirror, pressure on the mirror will be :

(i) Zero

(ii) I/C

(iii) 2 I/C

(iv) None of these

(m) Poynting vector is in the direction of :

(i) Electric field vector

(ii) Magnetic field vector

(iii) Propagation of wave

(iv) Perpendicular to electric field vector

(n) Velocity of plane Electromagnetic wave is given by :

(i) $C = \sqrt{\frac{\mu_o}{\epsilon_o}}$

(ii) $C = \sqrt{\frac{1}{\mu_o \epsilon_o}}$

(iii) $C = \sqrt{\mu_o \epsilon_o}$

(iv) $C = \mu_o \epsilon_o$

(o) If the grating has N lines then resolving power varies as :

(i) N^2

(ii) N

(iii) 1/N

(iv) $\sqrt{N}$

Group – A

2. Write the theory of Fresnel's diffraction at straight edge.

3. What do you understand by cardinal points ? Obtain the thick lens formula and discuss its focal points and principal points.

4. Discuss the construction and theory of a plane diffraction grating and explain different maxima and minima that are obtained by it.

5. Describe the construction and working of a Ruby Laser with the help of energy level diagram.

6. What is rotatory polarization ? Describe a half shade polarimeter for measurement of specific rotation produced by cane sugar solution.

7. What is zone plate ? Show that it has multiple foci. Compare the zone plate with a convex lens.

Group – B

8. Explain Poynting vector. Evaluate its magnitude for a plane electromagnetic wave in an isotropic medium.

9. What are normal and anomalous dispersion ? Give a theoretical explanation of the phenomena.

10. Write short notes on any **two** of the following :

    (a) Febry – Perot interferometer

    (b) Maxwell's field equations

    (c) He-Ne Laser

    (d) Resolving power of prism