31330

(NEP)

B.Sc. III Semester Degree Examination, February/March - 2023

PHYSICS

Wave Motion and Optics

Paper : DSC : A3

Time : 3 Hours **Maximum Marks : 60**

Instructions to Candidates :

1. Part : A - All questions are compulsory.
2. Part : B - Answer any five questions.

PART - A **(5×2=10)**

1. a. What is meant by a wave motion? Mention its characteristics.
   b. State the principle of superposition. When is it valid?
   c. Write the expression for velocity of transverse waves along a stretched string.
   d. What are Newton's ring? How are they formed?
   e. Mention the difference between a zone plate and a lens.

PART - B

2. a. What is progressive wave? Derive an expression for intensity of progressive wave.
   b. Calculate the velocity of sound waves in carbon dioxide at N.T.P. Density of carbon dioxide at NTP is 1.9777 Kgm^{-3} and the ratio of the specific heat capacities of the gas is 1.306. What will be its velocity at 300 K? **(6+4=10)**
3. a. What are lissajous figures? Find the resultant of two SHM of equal period, when they Act at right angles to each other?
   b. Two tuning forks P and Q produce 4 beats per second when sounded together. The frequency of P is 480 Hz. When Q is loaded with a wax the beats stop. Calculate the frequency of Q? **(6+4=10)**
4. a. Obtain the frequency of longitudinal vibrations of a bar fixed at both ends.
   b. The volume of the hall is 5900 m^3 and its total surface area of absorption of sound is 200m^2 and has absorption coefficient 0.4. Calculate the reverberation period of the hall. **(6+4=10)**

[P.T.O.

5. a. Explain young's double slit experiment to obtain interference pattern.
   b. Write a note on corpuscular model of light. **(6+4=10)**

6. a. Describe the Michelson interferometer with a neat diagram.
   b. In a Newton's ring experiment, the diameter of 10^{th} dark ring due to wavelength 6000 A° in air is 0.5×10^{-2}m. Find the radius of curvature of the lens. **(6+4=10)**

7. a. Discuss the Fraunhofer diffraction due to single slit and also discuss the intensity distribution on the screen.
   b. A parallel beam of sodium light is allowed to be incident normally on a plane grating having 4250 lines per centimeter and a second order spectral line is observed to be deviated through a 30°. Calculate the wavelength of the spectral line. **(6+4=10)**

8. a. Explain Quarter and half wave plate.
   b. A ray of light is incident on the surface of a glass plate of refractive index 1.732 at the polarizing angle. Calculate the angle of refraction of the rays. **(6+4=10)**

27321

B.Sc. III Semester Degree Examination, February/March 2022
PHYSICS
Paper : 3.1 (New) : Optical Instruments, Laser and Electrodynamics

Time : 3 Hours Max. Marks : 60

Instructions : 1) Part – ***A*** : ***All*** *questions are* ***compulsory***.
2) Part – ***B*** : *Solve* ***any five*** *questions.*

PART – A

1. Answer the following questions. **(10×1=10)**
   a) Define Coulomb.
   b) What is scalar field ?
   c) Write two applications of lasers.
   d) What is aberration ?
   e) Define dipole.
   f) Write the laplace equation in vector notation.
   g) Write the equation of continuity.
   h) Write two applications of Holography.
   i) What is the mass of electron ?
   j) What are principal points ?

PART – B

2. Obtain the expression for the equivalent focal length of two thin lenses placed co-axially in air and separated by a distance. Also derive the expression for α and β which gives the position of principal points. **10**

3. a) Show that the chromatic aberration in lenses is equal to the product of mean focal length and dispersive power of the material.
   b) A convex lens has a focal length for red colour 15.5×10^{-2}m. Its focal length for violet colour is 14.45×10^{-2}m. If an object is kept at a distance of 0.4m from the lens, calculate the longitudinal chromatic aberration produced by the lens. **(7+3=10)**

P.T.O.

4. a) With the help of energy band diagram, discuss the working of semiconductor laser.

   b) What is population inversion ? Explain briefly. **(7+3=10)**

5. a) State and prove Gauss divergence theorem and write its importance.

   b) Show that $\nabla(\phi + \psi) = \nabla\phi + \nabla\psi$. **(6+4=10)**

6. a) What is Solenoid ? Obtain an expression for the magnetic field at any point on the axis of solenoid.

   b) A circular coil has a radius of 0.1 m and a number of turns of 50. Calculate the magnetic induction at a point, at the centre of the coil, when a current of 0.1 A flows in it. **(7+3=10)**

7. a) State and explain Ampere's circuital law.

   b) Calculate the value of the torque on a current loop placed in a uniform magnetic field. **(5+5=10)**

8. a) Obtain the Maxwell's field equations for electromagnetic waves in isotropic non-conducting media.

   b) State and explain Poynting's theorem. **(6+4=10)**

27321(New)

B.Sc. III Semester Degree Examination, March/April - 2021

PHYSICS

Optical Instruments, Laser And Electrodynamics

Paper - 3.1

(New)

Time : 3 Hours **Maximum Marks : 60**

Instructions to Candidates:

1. Part - A: **All** are Compulsory.
2. Part - B: Solve any **Five** questions.

PART - A

Answer the following questions. **(10×1=10)**

1. a) What is meant by Chromatic aberration?

b) What are focal points?

c) What is meant by metastable state?

d) Define scalar product.

e) State Gauss divergence theorem.

f) State Columb's law in electrostatics.

g) Define electric potential at a point.

h) Define electric dipole.

i) What is solenoid.

j) Write the equation of velocity of light in a medium.

PART - B

2. a) What is meant by achromatic aberration? Derive the condition for achromatism of two thin lenses separated by a finite distance.

b) Two convex lenses of focal length 0.1m and 0.2m are placed 0.08m apart. Calculate the equivalent focal length. **(7+3=10)**

[P.T.O.

3. a) Derive an expression for the equivalent focal length of two thin converging lenses separated by a distance in a Co-axial system.

   b) Two converging lenses of Powers 5 diopters and 4 diopters are placed Coaxially 12cm apart. Find the focal length of combination. **(7+3=10)**

4. a) Describe the construction and working of semiconductor laser.

   b) Mention the application of laser. **(6+4=10)**

5. a) State and prove Stokes theorem.

   b) Show that $\nabla.(\nabla\phi) = \nabla^2\phi$. **(6+4=10)**

6. a) Obtain the expression for the magnetic field at a point due to a straight conductor of finite length.

   b) State and explain Biot - Savart's Law. **(6+4=10)**

7. a) Obtain the expression for the torque on a dipole in a magnetic field.

   b) A coil produces a self induced voltage of 60mV when the current in the coil varies at the rate of 30mA per milli second. What is the self inductance? **(6+4=10)**

8. a) Derive the electromagnetic wave equation in a free space.

   b) Mention the characteristics of electromagnetic waves. **(7+3=10)**

27321(New)

B.Sc. III Semester Degree Examination, Oct./Nov. - 2019

PHYSICS

OPTICAL INSTRUMENTS, LASER AND ELECTRODYNAMICS

PAPER- 3.1

(New)

Time : 3 Hours Maximum Marks : 60

Instructions to Candidates:

1. Part A : **All** are compulsory.
2. Part B : Solve any **Five** questions.

Part - A

1. Answer the following questions. **(10×1=10)**

a) What is the circle of least confusion?

b) What are principal points?

c) What is optical pumping?

d) State Stoke's theorem.

e) Define scalar field.

f) Write the Laplace equation.

g) State Biot - Savarti law.

h) State Ampare's circuital law.

i) Write the equation of continuity.

j) What is the velocity of electromagnetic waves in free space?

[P.T.O.

Part - B

2. a) Derive the condition for achromatism of two thin lenses separated by a finite distance.

   b) Calculate the focal lengths of a convex lens of crown glass (disperssive power 0.012) and a concave lens of flint glass (disperssive power 0.020). So that when placed in contact they form an achromatic converging combination of focal length 30 cm. $f_1 = 12$ cm $f_2 = -20$ cm $F = 30$ cm

   (6+4=10)

3. a) Derive an expression for the equivalent focal length of a coaxial system of two thin converging lenses separated by a distance.

   b) A Ramsden's eyepiece is to have an effective focal length of 3 cm. Calculate the focal lengths of the lens component and their distance of separation. **(7+3=10)**

4. a) Explain the construction and working of He - Ne laser with necessary energy level diagram.

   b) Write a note on spontaneous and stimulated emission of radiation. **(6+4=10)**

5. a) i) If $\bar{r}$ is the position vector of a point. Prove that curl $\bar{r} = 0$.

   ii) Show that $\nabla.(\phi\bar{A}) = \nabla(\phi).\bar{A} + \phi\nabla.\bar{A}$.

   b) Explain the physical significance of divergence. **(6+4=10)**

6. a) State and prove Gauss law in electrostatics.

   b) Calculate the magnetic field at a distance of 5×10^{-2} m due to a long straight conductor carrying a current of 150 mA. **(7+3=10)**

7. a) Show that current carrying loop behaves like a magnetic dipole.

   b) State Faraday's laws of electromagnetic induction and explain them. **(6+4=10)**

8. a) State and prove Poynting's theorem.

   b) Describe Hertz experiment to produce and detect the electromagnetic waves. **(6+4=10)**