

11321

B.Sc. III Semester Degree Examination, Nov./Dec. 2016

PHYSICS

Paper – 3.1 : Optical Instruments, LASER and Electrodynamics

Time : 3 Hours

Max. Marks : 80

**Instructions :** 1) Section – I is compulsory.  
2) Answer **any four** questions **each** from Section – II and from Section – III.

SECTION – I

(12×1=12)

1. Answer **any twelve** of the following :

A) Choose the correct answer :

i) The total number of cardinal points are

a) 2

b) 4

c) 6

d) 8

ii) The life time of atoms in a meta-stable state is

a)  $10^{-4}$  second

b)  $10^{-6}$  second

c)  $10^{-3}$  second

d)  $10^{-2}$  second

iii) The example for scalar fields are

a) distribution of temperature

b) magnetic potential

c) electric potential

d) all of the above

iv)  $\nabla \cdot \mathbf{B} = 0$  indicates

a) monopole exists

b) dipole exists

c) monopole does not exist

d) none of these

B) Fill in the blanks :

i) The focal lengths of field lens and eye lens in Huygens' eye piece are \_\_\_\_\_ and \_\_\_\_\_

ii) The S.I. unit of electric field is \_\_\_\_\_

iii) Laplace equation in electrostatics is expressed as \_\_\_\_\_

iv) Torque on a dipole is given by the formula \_\_\_\_\_

P.T.O.



C) State **true** or **false** :

- i) Ramsden's eye piece is called positive eye piece
- ii) Magnetic field at the centre of a circular coil carrying current is minimum.
- iii) Electromagnetic waves are purely transverse.

D) Answer the following in **one** or **two** sentences :

- i) What is normal magnifying power of a telescope ?
- ii) What is vector field ?
- iii) State Faraday's second law.
- iv) Write the equation of velocity of light in a medium.

#### SECTION – II

(4×4=16)

2. Derive the condition for minimum spherical aberration when two plano-convex lenses separated by a certain distance.
3. Explain spontaneous and stimulated emission of radiation.
4. State and explain Coulomb's law in electrostatics. Hence define coulomb.
5. State and explain Biot-Savart's law.
6. Write down Maxwell's equations in differential and integral forms.
7. Derive the equation of continuity.

#### SECTION – III

8. a) Derive the formula for equivalent focal length of two thin lenses placed coaxially in air and separated by a distance and also obtain an expression for principal point.  
b) Two thin converging lenses of focal lengths 0.1m and 0.2m are placed coaxially a certain distance apart. If the equivalent focal length is 0.8 m, find the distance between them. If this distance is made half, what is the equivalent focal length of the lenses ? (9+4)
9. a) Write a note on Holography.  
b) Write a note on Semi-conductor LASER. (9+4)



10. a) State and prove Gauss' theorem. Obtain an expression for electric field outside a charged sphere.
- b) Prove that  $\text{div}(\vec{A} + \vec{B}) = \text{div}\vec{A} + \text{div}\vec{B}$ . (9+4)
11. a) Derive an expression for magnetic induction at any point due to an infinitely long straight conductor carrying current.
- b) A solenoid of length 0.4 m and 4000 turns carries current of 5 A. Find the magnetic field on the axis well inside it. (9+4)
12. a) Derive an expression for equation of electromagnetic wave in an isotropic non-conducting medium.
- b) A plane electromagnetic wave travelling along x-direction in an unbounded loss less dielectric medium of  $\mu_r = 2$  and  $\epsilon_r = 5$  has peak electric field strength of  $10 \text{ V m}^{-1}$ . Calculate the velocity of the wave. Given  $\epsilon_0 = 8.854 \times 10^{-12} \text{ Fm}^{-1}$ . (9+4)
13. a) Derive Maxwell's first and second equations and interpret them physically.
- b) Describe Hertz experiment to produce electromagnetic waves. (9+4)
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