

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27
B.Sc. PHYSICS - III SEMESTER
SEMESTER EXAMINATION: OCTOBER-2019
PH 318–ELECTROMAGNETISM, SOUND AND PHYSICAL OPTICS

Time: 2½ hrs.

Max.Marks:70

*This question paper has **two** printed pages and **three** parts*

PART - A

Answer any **four** of the following:

(4 x 10 = 40)

1. (a) Derive an expression for the force experienced by a charge on the surface of charged conductor.
(b) Obtain an expression for electric potential at any point due to electric dipole. (5+5)
2. With the help of a neat diagram, explain the theory of a ballistic galvanometer. (10)
3. Derive Maxwell's field equations $\nabla \cdot \mathbf{B} = 0, \nabla \times \mathbf{E} = -\partial \mathbf{B} / \partial t$, also give their physical significance. (10)
4. (a) What are different factors that affect the velocity of sound?
(b) Obtain an expression for the shift in the fringes when a thin transparent sheet is introduced in the path of one of the interfering beams in the biprism experiment, also explain how this can be used to determine the thickness of mica sheet. (2+8)
5. (a) What is a zone plate? What are positive and negative zone plate?
(b) Describe the action of zone plates and show that it acts like a convex lens. (3+7)
6. Give the theory of retarding plates to obtain plane polarized, elliptically and Circularly polarised light (10)

PART - B

Solve any **four** of the following:

(4 x 5 = 20)

7. If $\mathbf{A} = 2xz^2\mathbf{i} - yz\mathbf{j} + 3xz^3\mathbf{k}$ find (i) $(\nabla \times \mathbf{A})$ and (ii) $\nabla \cdot (\nabla \times \mathbf{A})$ at the point (1, 1, 1)
8. A vertical copper disc of diameter 20cm makes 10 revols. /sec about a horizontal axis through its centre. A uniform magnetic field of 10^{-2} tesla acts perpendicular to the plane of the disc. Calculate the potential difference between its centre and rim in volt.
9. A parallel plate capacitor of plate area 10^{-2} m^2 and plate separation 10^{-2} m is charged to 100 volts. Then after removing the charging battery, a slab of insulating material of thickness $0.5 \times 10^{-2} \text{ m}$, relative permittivity 7 is inserted between the plates. Calculate the free charge on the plates of the capacitor, electric field intensity in air, electric field intensity in dielectric.

10. A plane transmission grating having 5000 lines per cm is used to obtain a spectrum of light from a sodium lamp in the second order. Calculate the angular separation between the two sodium lines whose wavelengths are 5890 Å and 5896 Å.
11. A brass rod of length 3 meter is clamped at its centre. It is made to vibrate longitudinally. Find the Young's modulus of brass if the density of brass is 8200 kg/m^3 and the frequency of the note produced is 600 HZ.
12. A soap film of $4 \times 10^{-7} \text{ m}$ thick is observed at 50° to the normal. Find the wavelengths of light in the visible spectrum which will be absent from the reflected light. ($n = 1.33$).

PART – C

13. Answer any **five** of the following: (5x 2 = 10)
- a) What is the direction of gradient of scalar function in a gradient field?
 - b) Can sound wave undergo polarization, Explain
 - c) A current loop behaves as a magnetic dipole. Explain
 - d) If the number of lines of a grating is increased, what effect does it produce?
 - e) Displacement current is real as conduction current. Explain.
 - f) If the temperature of air inside the Kundt's tube is increased, what happens to the length of the loop?