QP CODE: 24803832

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Reg No : .....

Name : .....

# INTEGRATED MSC DEGREE EXAMINATION, JULY 2024

## Fourth Semester

INTEGRATED MSC BASIC SCIENCE-PHYSICS

## CORE - IPH4CR03 - ELECTRODYNAMICS - I

2021 Admission Onwards

6D4754A0

Time: 3 Hours Weightage: 30

### Part A (Short Answer Questions)

*Answer any **eight** questions.*

*Weight **1** each.*

1. What is Kirchhoff's Voltage Law (KVL) and how is it applied in circuit analysis?
2. Define active and passive elements in electrical circuits.
3. Explain Skin effect
4. Explain why the electric field outside a perfect conductor is perpendicular to the surface?
5. Explain the susceptibility tensor for a crystal? What is its significance?
6. Write the relation connecting dielectric constant and electric susceptibility.
7. Write down Maxwell's divergence equations.
8. What is meant by induced dipoles?
9. Explain the principle of superposition of electromagnetic waves.
10. Define the terms group velocity and phase velocity.

(8×1=8 weightage)

### Part B (Short Essay/Problems)

*Answer any **six** questions.*

*Weight **2** each.*

11. Obtain an expression for the growth of current in a circuit containing Inductance (L) and resistance (R)
12. (a) What do you mean by : (i) Series Resonant Circuit, (ii) Parallel Resonant Circuit ? Distinguish between the two and also discuss where we use such circuits ?

13. Find the energy stored in a charged capacitor.

14. Show that the potential and hence the field due to a polarised object can be related to the potential due to bound charges.

15. State Maxwell's equation for time varying fields and from Maxwell's equation show that the charge is conserved in electromagnetic process.

16. Calculate the value of the Poynting vector at the surface of sun if the power radiated by it is 3.8 x 10 26 watt. Calculate the average solar energy incident on the earth per unit area in one second. Given radius of sun = 7 x108 m and radius of earth = 1.5 x 1011 m.

17. Calculate the strength of a uniform electric field if it is to have the same energy density as that possessed by a 4 x 10-2 T magnetic field.

18. Silver is an excellent conductor, but it is expensive. Suppose you were designing a microwave experiment to operate at a frequency of 1010 Hz. How thick would you make the silver coating? Given $\rho = 1.6 \times 10\text{-}8$ and $\varepsilon = \varepsilon 0$

(6×2=12 weightage)

**Part C (Essay Type Questions)**

*Answer any **two** questions.*

*Weight **5** each.*

19. State and prove (a) maximum power transfer theorem and (b) Reciprocity theorem

20. Give the physical interpretation of bound charges? Find the expression for electric field inside a dielectric.

21. Discuss the electrodynamic boundary conditions.

22. Explain the propagation of electromagnetic waves in an isotropic dielectric medium. Show that the electric and magnetic fields are mutually perpendicular and energy flux can be expressed as the product of energy density and velocity.

(2×5=10 weightage)