M. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023
SEMESTER 1 : PHYSICS
COURSE : **21P1PHYT03 : ELECTRODYNAMICS**
(For Regular - 2023 Admission and Improvement/Supplementary -2022/2021 Admissions)

Duration : Three Hours   Max. Weights: 30

PART A
Answer any 8 questions   Weight: 1

1. Obtain the relation between amplitudes of electric and magnetic fields, in an EM wave.   (R, CO 2)

2. Velocity fields cannot contribute to radiation. Why?   (A, CO 3)

3. Obtain the relation between magnitude of both fields in an EM wave.   (R, CO 2)

4. What are waves?   (R, CO 2)

5. Quote Maxwell's stress tensor.   (R, CO 1)

6. What do you mean by Minkowski's force?   (U, CO 4)

7. A railcar carrying a coil, when passed through a magnetic field of a magnet kept on the ground, will have an emf induced in it. Give the explanation for this, from the point of view of a person on the train.   (U, CO 1)

8. What is the physical basis for radiation reaction?   (U, CO 3)

9. How can we achieve impedance matching using a quarter wave line?   ()

10. Differentiate between displacement current and electric current.   (U, CO 1)

(1 x 8 = 8)

PART B
Answer any 6 questions   Weights: 2

11. Find the magnetic field at the center of a square loop, carrying current.   (A, CO 1)

12. An non-metallic annular ring of inner and outer radii *a* and *b* respectively is cut along its diameter. A wire is attached to the boundary of one of the (C shaped) piece and a current which increases linearly with time is made to pass through it. Calculate the retarded vector potential and the electric field at the center.   (A, CO 3)

13. An infinite plane slab of thickness 2d, and extending in x and z directions, carries a uniform volume charge density. Plot the electric field as a function of y, where y = 0, is at the center.   (A, CO 1)

14. The index of refraction of diamond is 2.42. Plot the curve of reflectivities at various angles of incidence for air:diamond interface.   (A, CO 2)

15. Find the first and second order TE cut off wavelengths of an infinite parallel plate waveguide with plate separation of 1.5 cm.   (A, CO 4)

16. Differentiate between E and H plane patterns. Write a note on radiation pattern lobes.   ()

17. Calculate the radiation damping of a particle attached to a spring of natural frequency ω_0 driven at frequency ω (A, CO 3)

18. The intensity of sunlight hitting earth is about 1300 W/m^2. If sunlight hits a perfect absorber, what pressure does it exert?   (A, CO 2)

(2 x 6 = 12)

PART C
Answer any 2 questions   Weights: 5

19. Obtain the reflection and transmission coefficients for a plane electromagnetic wave incident normally on a plane boundary between two linear dielectric media.   (U, CO 2)

20. Derive the general transformation rules for electromagnetic fields.   (A, CO 4)

21. Derive Maxwell`s equations, in free space. Explain their physical implications. Show how Maxwell corrected Ampere`s law.   (U, CO 1)

22. Derive the Lienard - Wiechert potentials for a moving charge.   (A, CO 3)

(5 x 2 = 10)

OBE: Questions to Course Outcome Mapping

CO	Course Outcome Description	CL	Questions	Total Wt.
CO 1	To outline the concepts of electrodynamics.	A	5, 7, 10, 11, 13, 21	12
CO 2	To apply Maxwell's equations and discuss EM waves	A	1, 3, 4, 14, 18, 19	12
CO 3	To apply the concepts of EM radiation	A	2, 8, 12, 17, 22	11
CO 4	To apply the concepts of (i) relativity in various cases and (ii) waveguides.	A	6, 15, 20	8

Cognitive Level (CL): Cr - CREATE; E - EVALUATE; An - ANALYZE; A - APPLY; U - UNDERSTAND; R - REMEMBER;