Reg. No ..... Name **23U506**

B. Sc. DEGREE END SEMESTER EXAMINATION : NOVEMBER 2023

SEMESTER 5 : PHYSICS

COURSE : **19U5CRPHY05 : ELECTRICITY AND ELECTRODYNAMICS**

(For Regular 2021 Admission and Supplementary 2020/2019 Admissions)

Time : Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

1. An electric field of 10^5N/C points towards east at a certain point. What is the direction of the magnetic field also calculate the magnitude of the force on a charge -3μC placed at that point.
2. Illustrate voltage and current waveforms at the input and output of a transformer.
3. Illustrate the decay of current in a CR circuit.
4. Comment on the net force and torque on a dipole placed in a uniform electric field.
5. Discuss energy of EM waves.
6. Give the work done to move a point charge from one point to another on an equipotential surface?
7. Illustrate voltage and current waveforms in a LR circuit.
8. Illustrate voltage and current waveforms in an inductive circuit.
9. In the case of a point charge (+q) draw the graph showing the variation of electrostatic potential (V) with respect to distance from the charge (r).
10. State, what is meant by polarization of EM waves.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. A straight horizontal copper wire has a current of I = 28A through it. Find the minimum magnitude B of the magnetic field needed to suspend the wire.The linear density of the wire is $46.6g/m$.
12. The magnetic field B due to a current carrying circular loop of radius 12cm at its center is $0.5 \times 10^{-4}T$. Find the magnetic field due to this loop at a point on the axis 5.0 cm from the centre.
13. A fat wire of radius a, carries a constant current I, uniformly distributed over its cross section. A narrow gap in the wire of width w< Derive the wave equation in a magnetic field
14. A coil of self inductance 3 mH and resistance of 17 ohms is connected in parallel with a capacitance of 2 nF. Find (i) the frequency at which the current is minimum and (ii) the peak value of current if the peak value of voltage is 2 V.
15. An alternating potential of 120 V at 60 Hz is applied across a series circuit having an inductance of 5 Henry, a resistance of 100 ohm and a variable capacitance. At what value of the capacitance will the current in the circuit be in phase with the applied voltage? Calculate the current in this condition.
16. If the charge on a capacitor of capacitance 2 micro farads which is leaking through a high resistance of 100 Mohms, is reduced to half its value, calculate the time of leakage.

17. A source of e. m. f. 50 V r.m.s. is connected across a coil. When the supply frequency is 50 Hz, the power consumed is found to be 100 W where as when the frequency is increased to 100 Hz, the power consumption becomes 50 W. Find the self inductance and resistance of the coil.

18. A horizontal rod $0.2m$ long is mounted on a balance and carries a current. At the location of the rod a uniform horizontal magnetic field has magnitude of $0.067\ T$ and direction perpendicular to the rod. The magnetic force on the rod is found to be $0.13\ N$. What is the current in the rod?

(4 x 6 = 24)

PART C

Answer any 2 (10 marks each)

19. Setup the differential equation governing the alternating current flow in a parallel LCR circuit and obtain an expression for current through the circuit. Comment about the related phase difference term.

20. Derive Maxwell's equations for free space and matter.

21. Discuss Seebeck, Peltier and Thomson effects. Explain their occurence on the basis of electron theory.

22. (a) Show that the divergence of the magnetic field is zero and find the expression for the curl of the magnetic field. (b) Find the magnetic field of a very long solenoid, consisting of n closely wound turns per unit length on a cylinder of radius R, each carrying a steady current I.

(10 x 2 = 20)