Reg. No ..... Name **22U506**

B. Sc. DEGREE END SEMESTER EXAMINATION: OCTOBER 2022

SEMESTER 5 : PHYSICS

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

(For Regular - 2020 Admission and Supplementary - 2019 Admission)

Time: Three Hours Max. Marks: 60

PART A

Answer any 8 (2 marks each)

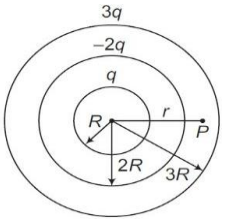
1. Does the electrostatic energy obey the superposition principle? Explain briefly.
2. An electric field of 10^5N/C points towards west at a certain point. What is the direction and magnitude of the force on a charge +2μC placed at that point.
3. Write the expression for current and voltage in a damped LCR circuit.
4. State, the law of intermediate metals
5. Write Maxwell's equations
6. Electric field lines cannot begin and stop in mid space. Discuss briefly.
7. Illustrate voltage and current waveforms in a CR circuit.
8. State, superposition theorem.
9. What is the physical concept of poynting theorem
10. Electric field lines can never form a closed loop. Explain.

(2 x 8 = 16)

PART B

Answer any 6 (4 marks each)

11. Three conducting spherical shells have charges +q, -2q, and +3q as shown in the figure. Find the electric field at the point P as shown in the figure.



12. A charged capacitor of capacitance 0.01 micro farads, is made to discharge through a circuit consisting of a coil of inductance 0.1 H and an unknown resistance. What should be the maximum value of the unknown resistance, if the discharge of the capacitor has to be oscillatory?
13. 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. What will be potential drops across the circuit elements?
14. A long cylinder carries a uniform charge density which is proportional to the distance from the axis, that is $\rho = cs$ for some constant c. Find the electric field inside the cylinder.

15. A wire of length1 carries a current I along the x - axis. A magnetic field of $B = B_0(\hat{x} + \hat{y} + \hat{z})$ exists in the space. Find the magnitude of the magnetic force acting on the wire.

16. Derive the wave equations of magnetic field.

17. A circuit consists of a noninductive resistance of 50 ohms, an inductance of 0.3 Henry, a resistance of 2 ohms and a capacitance of 40 microfarads in series and is supplied with 200 V 50 Hz, Find the impedance of the circuit.

18. A circuit consists of a noninductive resistance of 60 ohms, an inductance of 0.4 Henry, a resistance of 3 ohms and a capacitance of 50 microfarads in series and is supplied with 200 V 50 Hz, Find the impedance of the circuit.

(4 x 6 = 24)

PART C
Answer any 2 (10 marks each)

19. State and prove Thevenin's and Norton's theorems.

20. Write Faradays law in Electromagnetics induction. A long solenoid, of radius a, is driven by an alternating current, so that the field inside is given by B(t)=B0cos(ωt)z^. A circular loop of wire, of radius a=2 and resistance R, is placed inside the solenoid, and coaxial with it. Find the current induced in the loop, as a function of time

21. Show how Maxwell's made the correction for Ampere circuital law. And hence derive the equations for electromagnetic waves

22. Discuss the oscillatory growth of electric current in a LCR circuit.

(10 x 2 = 20)