B. Sc. DEGREE END SEMESTER EXAMINATION MARCH 2018

SEMESTER – 4: PHYSICS (CORE COURSE)

COURSE: **15U4CRPHY4: ELECTRICITY AND ELECTRODYNAMICS**

Common for Regular (2016 Admission) & Supplementary (2015 & 2014 Admissions)

Time: Three Hours   Max. Marks: 60

PART A

Answer *all* questions. Each question carries *1* Mark

1. Define the time constant for an L-R series circuit for the Decay of current?

2. Define Form Factor for alternating current

3. Define the impedance of a series LCR circuit.

4. Let several point charges $q_1, q_2, ……q_n$ be situated at distances $r_1, r_2, ...r_n$ from Q. Using the principle of superposition, write down the expression for total electrostatic force on Q.

5. Write down Poisson's equation and Laplace's equation. State in which region Poisson's equation reduces to Laplace's equation.

6. Write down Maxwell's equations.

7. What is $\nabla \cdot B$?

8. State Kirchhoff's law in varying currents.   (1 x 8 = 8)

PART B

Answer *any six* questions. Each question carries *2* Marks

9. Define a parallel resonant circuit. Why it is called a rejecter circuit?

10. Explain ideal constant voltage source and ideal constant current source

11. State Maximum Power Transfer Theorem.

12. Briefly explain skin effect.

13. An infinite plane carries a uniform surface charge σ. Find its electric field.

14. Let the direction of propagation of an electromagnetic wave is positive x axis. The expression for electric field of the wave at a particular point x at time t is $\breve{E}_0 \cos(kx - \omega t + \delta)\hat{\jmath}$. Write down the expression for magnetic field B at the same point, at the same time.

15. Explain divergence of a vector field

16. Define Poynting vector? Represent it mathematically.   (2 x 6 = 12)

PART C

Answer *any four* question. Each question carries *5* Marks

17. A Capacitor of capacitance 0.2 µF is charged through a resistance of 20 megohms to a certain potential and then discharged. Find the time taken for the potential to fall to half its original value.

18. At what frequency could a 2 H inductance coil have the inductive reactance of 1000 ohms. Calculate also the capacitative reactance of a capacitor of capacitance 0.02 µF at this frequency.

19. Find the potential inside and outside a spherical shell of radius R which carries a uniform surface charge. Set the reference point at infinity.

20. Prove that the magnetic field produced by an infinite uniform surface current $K = k\,\hat{\imath}$ covering the xy plane is independent of the distance from the plane.

21. Use Gauss's law to find the electric field inside a uniformly charged sphere (charge density ρ)

22. What is the electric potential at point P, located at the centre of a square with point charges at vertices (as shown in figure)? The distance d is 1.3 m and the charges are $q_1 = 12$ nC, $q_2 = -24$ nC, $q_3 = +31$ nC, $q_4 = 17$ nC. (1 nC $= 10^{-9}$ C)
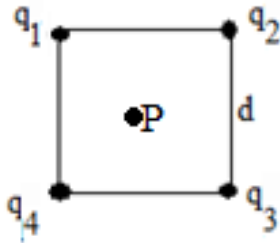
(5 x 4 = 20)

PART D

Answer **any two** question. Each question carries **10** Marks

23. Show how Maxwell modified Ampere's law in magnetostatics.

24. State and illustrate Thevenin's theorem.

25. What is electric potential energy? Obtain the expression for the potential energy of a point charge distribution.

26. Discuss the properties of electromagnetic waves in conductors and derive the modified wave equation for E and B.

(10 x 2 = 20)

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