

**B. Sc. DEGREE END SEMESTER EXAMINATION – JULY 2021****SEMESTER – 4: PHYSICS (CORE COURSE)****COURSE: 15U4CRPHY4 – ELECTRICITY AND ELECTRODYNAMICS**

*(Common for Improvement 2018 admission / Supplementary 2018/2017/2016/2015 admissions)*

Time: Three Hours

Max. Marks: 60

**PART A (Very short answer questions)*****Answer all questions. Each question carries 1 Mark***

1. L/R has the dimensions of .....
2. In BG, how charge and current sensitivities are related.
3. The average value of ac during one half cycle is ..... and during one complete cycle is .....
4. Write down the differential form of Gauss' law.
5. The induction of charges on a dielectric when placed in an electric field is known as .....
6. What was the necessity of modifying Ampere's law in formulating the Maxwell's equation?
7. What does the Poynting vector represent?
8. What was the purpose of Hertz experiment? (1 x 8 = 8)

**PART B (Short answer)*****Answer any 6 questions. Each question carries 2 Marks***

9. Only high resistance can be measured using capacitor by the leakage method. Why?
10. What is Q factor of a resonant circuit? How is it important in explaining the sharpness?
11. Where do we apply Thevenin's and Norton's theorems?
12. Differentiate between star and delta connection.
13. What is the importance of Poisson's and Laplace's equations?
14. Explain the principle of superposition in electrostatics.
15. Express the electric and magnetic fields in terms of scalar and vector potentials and indicate its significance.
16. What is skin depth? Explain. (2 x 6 = 12)

**PART C (Problem/Derivations)*****Answer any 4 question. Each question carries 5 Marks***

17. A 50V battery is used to charge a capacitor of  $10\mu\text{F}$ . It is then discharged through a  $100\text{k}\Omega$  resistor. Determine the potential difference and charge across the capacitor after 2s. What is the time constant?
18. State and prove maximum power transfer theorem.
19. Two spheres of diameter 10cm have charges  $-2 \times 10^{-8}\text{C}$  and  $3 \times 10^{-8}\text{C}$ . Find the potential of the spheres and the potential at the midpoint of their centres, if the distance between their centres is 2m.

20. Three equal point charges  $+q$ , are located at the vertices of an equilateral triangle of side  $a$ . What charge must be placed at the centroid of the triangle so that the work done in bringing it there be zero?
21. Find the reflection and transmission coefficients for glass of refractive index 1.648. Also find the Brewster angle and the velocity of light through it.
22. The electric field vector of a plane electromagnetic wave is given by  $\mathbf{E}(x, t) = 10e^{j(kx - \omega t)}$ . Calculate the energy and momentum density. Find the Poynting vector and show that it is  $c$  times the energy density of the field.

(5 x 4 = 20)

**PART D (Long answer questions)**

***Answer any 2 question. Each question carries 10 Marks***

23. Analyse the growth of charge through a series LCR circuit when a dc voltage is applied to it.
24. Apply Gauss's law to find the field due to (i) a line of charge (ii) sheet of charge and use it to determine the field in between two sheets.
25. Give the Maxwell's equations inside the matter both in differential and integral forms. How do they modify in free space? State the laws of origin of these equations.
26. Explain the boundary conditions for electromagnetic fields.

(10 x 2 = 20)

\*\*\*\*\*