21U410S (Pages: 2) Name: ……………………..

Reg. No: ..…………………

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2023

(CUCBCSS-UG)

CC15U PH4 B04 – ELECTRODYNAMICS - I

(Physics - Core Course)

(2015 to 2018 Admissions – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

Section A

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

1. The value of $\nabla \cdot \boldsymbol{B}$ is …………
2. Torque experienced by a dipole p in a uniform electric field E is given by …………
3. Electric field inside the conductor is …………
4. Differential form of Poisson's equation is …………
5. Work done by the magnetic field is …………
6. The atoms or molecules with odd number of electrons are normally ………… materials.
7. The diamagnetic property of a material is due to …………
8. The magnetic force acting on a charge at rest is …………
9. The expression for the energy stored in a capacitor is …………
10. The relation connecting D, E and P is …………

(10 × 1 = 10 Marks)

Section B

Answer ***all*** questions. Each question carries 2 marks.

11. State and explain Coulomb's law.
12. What is meant by domains of a ferromagnetic material?
13. Starting from the integral form of Gauss flux theorem, obtain its differential form.
14. Distinguish between electrostatic and magnetostatic fields.
15. State and explain Ampere's Law
16. Write down the basic properties of a conductor.
17. Explain 'classic image problem'.

(7 × 2 = 14 Marks)

Section C

Answer any ***five*** questions. Each question carries 4 marks.

18. Define electric potential. Show that electric field is the negative gradient of potential
19. Explain the effect of magnetic field on atomic orbits.

20. Explain H-B curve and hysteresis.
21. Derive the electrostatic boundary conditions.
22. Distinguish between Dia, Para and Ferro magnetic materials.
23. State and explain Uniqueness theorem.
24. Derive Clausius – Mossotti relation.

(5 × 4 = 20 Marks)

Section D

Answer any ***four*** questions. Each question carries 4 marks.

25. Find magnetic field $\bar{B}$ due to a long current carrying conductor, using Ampere's law.
26. Find the electric field and potential inside and outside due to a uniformly charged dielectric sphere of radius R.
27. An electrostatic field is given by $\vec{E} = y^2\hat{\imath} + (2xy + z^2)\hat{\jmath} + 2yz\hat{k}$. Check whether it is an admissible electrostatic field or not.
28. Find the potential of the field between two parallel conducting plates extending to infinity which are kept at potentials V_1 and V_2 respectively.
29. Explain with necessary theory the Cyclotron motion.
30. Derive the relation $\vec{F} = \nabla(\vec{m}.\vec{B})$.
31. An electron is accelerated by 300 V enters a magnetic field of 0.05 T at an angle of 30^o . Find (i) radius of the helical path of the electron (ii) angular velocity (iii) pitch of the helical path.

(4 × 4 = 16 Marks)

Section E (Essays)

Answer any ***two*** questions. Each question carries 10 marks.

32. State and prove Gauss's law. Using Gauss's law find the electric field due to a uniformly charged spherical conductor.
33. Explain Biot-Savart Law. Derive an expression for the magnetic field at a distance z above the centre of a circular loop of radius R, which carries a steady current I.
34. Explain the technique of method of images. Evaluate the potential and induced charge on a conducting plate due to a point charge at a point.
35. Derive an expression for the magnetic field inside a

    (1) Solenoid (2) Toroid.

(2 × 10 = 20 Marks)

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