19U408S (Pages: 2) Name: ……………………….

Reg. No: ……………………

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2021

(CUCBCSS-UG)

CC15U PH4 B04 - ELECTRODYNAMICS - I

(Physics – Core Course)

(2015 to 2018 Admission – Supplementary/Improvement)

Time: Three Hours Maximum: 80 Marks

Section A

Answer ***all*** questions. Each question carries1 mark.

1. Write the integral and differential forms of Gauss's law.
2. The expression for charge q in terms of surface charge density σ is ....
3. The expression for the energy stored in a capacitor is ....
4. Write the expression for the mechanical force acting on the surface of a charged conductor.
5. What do you mean by dielectric strength of a material?
6. The magnetic force acting on a charge at rest is ....
7. Two parallel conductors carrying currents in the same direction will .... each other.
8. The diamagnetic property of a material is due to ....
9. Curie point of steel is nearly ....
10. A substance having relative permeability less than one is ....

(10 × 1 = 10 Marks)

Section B

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

11. Graphically represent the electric field and potential with distance from the centre for spherical charged conducting sphere.
12. Starting from Gauss flux theorem, obtain Poisson's equation and Laplace's equation.
13. Explain polarizability tensor.
14. Distinguish between polar and non-polar molecules. Give examples.
15. What are dia, para and ferromagnetic substances?
16. What are bound currents?
17. What is Lorentz force?

(7 × 2 =14 Marks)

Section C

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

18. In the case of electrostatic force field shows that curl E is zero.
19. Show that electric field is the negative gradient of potential.

20. Obtain the relation between the three electric vectors **D**, **E** and **P**.
21. Find an expression for the potential due to a polarized dielectric object.
22. A current loop of wire of edge a carries a current I. Derive an expression for the magnetic flux density at the centre of the loop.State and explain first uniqueness theorem.
23. Starting from Ampere's law, show that H describes a non-conservative field.

(5 × 4 = 20 Marks)

Section D

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

24. Find the electric field and potential inside and outside due to a uniformly charged dielectric sphere of radius R.
25. Check whether the electric field $\boldsymbol{E} = y^2\hat{\imath} + (2xy + z^2)\hat{\jmath} + 2yz\hat{k}$ is admissible or not.
26. Show that the relation connecting bound charge and free charge is $\rho_b = -\left(\frac{\chi_e}{\chi_e + 1}\right)\rho_f$
27. A circular coil of 100 turns and radius 5 cm carrying a current of 2.5 A is placed in uniform magnetic field of 0.4 T. The normal to the plane of the coil makes an angle 30^0 with the field. What is the torque on the coil?
28. What is the velocity and kinetic energy of a proton which undergoes in circular path of radius 1 m under a magnetic field of 10^{-2} T?
29. A wire of length 60 cm and mass 10 gm is suspended by two vertical wires at its ends in a magnetic field of 0.4 T. What is the magnitude of current required to remove the tension in the supporting wires?
30. Determine the potential between two parallel plates at x=0 and x=d which are kept at potentials V1 = 500 V and V2 =0.

(4 × 4 = 16 Marks)

Section E

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

31. With necessary theory, obtain electrostatic boundary conditions. Discuss about work and energy in electrostatics.
32. Derive the relation between polarizability and susceptibility and hence arrive at Clausius Mossotti relation.
33. State and prove Ampere's circuital theorem. Obtain the differential form of it.
34. Derive an expression for the torque experienced by a dipole placed in a uniform magnetic field. When the dipole is in a non-uniform field, derive and expression for the force.

(2 × 10 = 20 Marks)

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