16U408 (Pages: 3) Name: ……..

Reg.No…….

FOURTH SEMESTER B.Sc. DEGREE EXAMINATION, APRIL 2018

(Regular/Supplementary/Improvement)

(CUCBCSS-UG)

CC15UPH4 B04 - ELECTRODYNAMICS I

(Physics- Core Course)

(2015 Admission onwards)

Time: Three Hours Maximum: 80 Marks

Section A

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

1. Magnitude of electric field is graphically represented by……...
2. Electric field inside the conductor is ……...
3. Superposition principle is not obeyed by ……..energy.
4. Solution of Laplace's equation is in the form of ……...
5. Differential form of Poisson's equation is ……...
6. Susceptibility of vacuum is ……...
7. Potential of a polarized object is due to the presence of……...
8. True/False: 'Magnetic forces do no work'.
9. $\nabla.(\nabla XA)$is equal to……...
10. In a small piece of iron, individual dipoles align in relatively small patches called ……....

(10 x 1 = 10 Marks)

Section B

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

11. Discuss the advantage of integral form of Gauss Law over the differential form.
12. Write short note on the fundamental laws of electrostatics.
13. What is meant by Faraday's cage? Explain its working.
14. State and prove the first uniqueness theorem.
15. Explain 'classic image problem'.
16. Distinguish between bound and free charges.
17. State and explain Ampere's Law.

(7 x 2 = 14 Marks)

Section C

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

18. Derive the electrostatic boundary conditions.
19. Comment on 'Gauss law is always true, but it is not always useful'.
20. Explain why Laplace's equation cannot tolerate local maxima or minima.
21. Show that the forces acting on a dielectric placed between a parallel plate capacitor depends on its capacitance.
22. Derive an expression for the magnetic field at a distance *x* from a long straight wire carrying a steady current *I*.
23. Define magnetic vector potential and derive the Poisson's equation in terms of A.
24. Show that magnetization is not due to magnetic monopoles.

(5 x 4 = 20 Marks)

Section D

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

25. Find the capacitance of two concentric spherical metal shells with radii 'a' and 'b'.
26. A charge $10\sqrt{2}\ C$ is located at $3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}\ m$. Calculate the electric field intensity at a point having position vector $5\hat{\imath} + 4\hat{\jmath} + 3\hat{k}\ m$.
27. A point charge *q* of mass *m* is released from rest at a distance *d* from an infinite grounded conducting plane. How long will it take for the charge to hit the plane?
28. A coaxial cable consists of metal core of *1 mm* radius within an outer metal of *0.5 cm* radius separated by an insulating material of dielectric constant *6*. Find the energy stored in *8 Km* length of the cable when *10,000 Volts* is applied between the core and the sheath.
29. A solenoid has *800* turns over a length of *0.5 m* and area of cross-section $0.2\ m^2$. When the current is *8 A*, what will be the magnetic moment and the magnetic field at the ends?
30. An electron is accelerated by *300 V* enters a magnetic field of *0.05 T* at an angle of 30^0. Find (i) radius of the helical path of the electron (ii) angular velocity (iii) pitch of the helical path.
31. When a magnetic bar of cross-section $0.1\ cm^2$is placed in a magnetizing field *3200 A/m*. the magnetic flux in the specimen is $2.41\ X\ 10^{-5}\ Wb$. Find the permeability and susceptibility of the material.

(4 x 4 = 16 Marks)

Section E

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

32. What is meant by electric potential? Show that electric field is the gradient of this potential. Also discuss the advantage of this potential formulation.
33. Define atomic polarizability and polarizability tensor. Derive an expression for the torque about the centre of the dipole in a uniform and non-uniform field.
34. 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*.
35. Discuss the physical interpretation of bound current and derive an expression of magnetic vector potential in terms of bound current.

(2 x 10 = 20 Marks)

****