



Reg. No. :

Name :



K16U 1580

V Semester B.Sc. Degree (CCSS-Supple./Imp.)
Examination, November 2016
Core Course in Physics
5B06 PHY : ELECTRODYNAMICS – I
(2013 and Earlier Admissions)

Time : 3 Hours

Max. Weightage : 30

SECTION – A

Choose the **correct** answer. **Each** bunch carries a weightage of 1.

1. i) Electrostatic field is
 - a) Solenoidal
 - b) Irrotational
 - c) Proportional to square of distance from a point charge
 - d) None of the above
- ii) Volume current density is
 - a) Current per unit Volume
 - b) Current per unit Area
 - c) Current per unit length
 - d) Charge per unit length
- iii) A hollow metal sphere of radius 5 cm is charged such that the potential on its surface is 10 V. The potential at a distance of 2 cm from the centre of the sphere
 - a) 0 V
 - b) 4 V
 - c) 10 V
 - d) 10/3 V
- iv) Which is not a characteristic property of electric conductor ?
 - a) Electric potential is same through out the conductor
 - b) Electric charges remain only on the surface of the conductor
 - c) Electric field inside the conductor is zero
 - d) The electric field inside the conductor depends upon the charge

P.T.O.



2. i) Which one of the given is a polar material
 a) Air b) Benzene c) Water d) Hydrogen
- ii) Volume charge density of an object having uniform polarization
 a) $\bar{P} \cdot \bar{n}$ b) $\bar{\nabla} \cdot \bar{P}$ c) $-\bar{\nabla} \cdot \bar{P}$ d) \bar{P}
- iii) If some insulating material is introduced between the plates of a parallel plate capacitor, its capacitance will
 a) Increase b) Decrease
 c) Remains same d) Become infinity
- iv) Of the following which one is suitable for making transformer core is
 a) Ni b) Al c) Soft iron d) Steel

(2×1=2)

SECTION – B

Answer **any six** questions. **Each** question carries a weightage of 1.

3. What is physical definition of gradient of a scalar field ?
4. What is the difference between solenoidal and irrotational fields ?
5. Write down Gauss's law in differential form.
6. Prove that $\bar{\nabla} \times \bar{E} = 0$.
7. What is a linear dielectric ?
8. What is atomic polarizability ?
9. Show that no work is done by a magnetic field on a charged particle moving in it.
10. Write down magnetostatic boundary conditions. (6×1=6)

SECTION – C

Answer **any nine** questions. **Each** question carries a weightage of 2.

11. Prove that (1) $\text{curl grad } \Phi = 0$ 2) $\text{div (curl } F) = 0$.
12. Find the area of a parallelogram formed by $A = 2\hat{i} + 3\hat{j}$ and $B = 4\hat{j} - 2\hat{k}$.
13. Find the field 12 cm above the center of a line of charge 5 cm having $2.6\mu\text{C}$.



14. Find the electric potential on the surface of a nucleus having mass number 64 and atomic number 30. Take charge of a proton as $1.6 \times 10^{-19} \text{ C}$ and radius of nucleus as $1.2 \times 10^{-15} \text{ m}$.
15. Derive Gauss's law in differential form inside a dielectric.
16. A sphere of linear dielectric material is placed on an originally uniform electric field E_0 . Find the new field inside the sphere, if the dielectric constant is K.
17. Two identical drops are charged to the same potential V. Find the new potential if they coalesce into one drop.
18. Prove that the tangential component of electric field is continuous at any boundary of a charged surface.
19. An electron accelerated by 300 V enters a magnetic field of 0.05 T at an angle 30° . Find
 1) The radius of the helical path of the electron
 2) Angular velocity and
 3) Pitch of the helical path.
20. Calculate the work done by the force $F = 3\hat{i} + 2\hat{j} + 8\hat{k} \text{ N}$ in moving an object through a displacement of $2\hat{i} + 4\hat{j} - 2\hat{k} \text{ m}$. Also find the component of the force acting along the direction of displacement.
21. A charge of $20\mu\text{C}$ is 1 m above a large block of a linear dielectric material of susceptibility 6. Find the force on the charge and its direction.
22. Find the potential inside a non-conducting sphere of radius 30 cm, uniformly charged with $100\mu\text{C}$ at a point 10 cm away from the center. (9×2=18)

SECTION – D

Answer **any one** question. Carries a weightage of 4.

23. State and explain Biot-Savart law. Find the magnetic field at a distance 'z' above the center of a circular loop of radius 'R' carrying current 'I'.
24. Derive Clausius-Mossotti formula connecting polarizability and dielectric constant. (1×4=4)