Royal College of Arts, Science & Commerce
T.Y.B.Sc.
Semester V Sample Paper
Physics Paper IV (USPH504)
Electrodynamics

Constants:

1] $\varepsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{Nm^2}$

2] $\mu_0 = 4\pi \times 10^{-7} \frac{N}{A^2}$

3] Electronic charge = $1.6 \times 10^{-19} C$

Q.1 Select correct answer

1. The Electric field intensity at a point due to a point charge is inversely proportional to.
   A) charge
   B) size of the charge
   C) distance of the point charge
   D) square of the distance from the charge

2. Which of the following law gives a relation between the electric flux through any closed surface and charge enclosed by the surface?
   A) Coulomb's law
   B) Newton's law
   C) Gauss's law
   D) Ampere's law

3. The differential form of Gauss's law in electrostatics can be expressed as …
   A) $\vec{\nabla} \cdot \vec{E} = \frac{\rho}{\varepsilon_0}$
   B) $\vec{\nabla} \cdot \vec{E} = \rho \varepsilon_0$
   C) $\vec{\nabla} \cdot \vec{E} = 0$
   D) $\vec{\nabla} \cdot \vec{E} = \frac{Q}{\varepsilon_0}$

4. The electrostatic field at any point between the surface and centre of solid conducting charged sphere of radius R is
   A) $E = \frac{1}{4\pi\varepsilon_0} \frac{q}{r^2}$
   B) $E = \frac{1}{4\pi\varepsilon_0} \frac{q}{R^2}$
   C) zero
   D) $E = \frac{1}{4\pi\varepsilon_0} \frac{q^2}{r^2}$

5. Poisson's equation is stated as _____.
A)$\nabla^2 V = -\frac{\rho}{\varepsilon_0}$
B)$\nabla^2 E = \frac{\rho}{\varepsilon_0}$
C)$\nabla^2 V = -\frac{Q}{\varepsilon_0}$
D)$\nabla^2 E = \frac{Q}{\varepsilon_0}$

6. The volume charge density and surface charge density are defined as respectively
A)$\rho_b = \vec{\nabla} \cdot \vec{P} \& \sigma_b = -\vec{P} \cdot \hat{n}$
B)$\rho_b = -\vec{\nabla} \cdot \vec{P} \& \sigma_b = \vec{P} \cdot \hat{n}$
C)$\rho_b = -\vec{\nabla} \cdot \vec{P} \& \sigma_b = -\vec{P} \cdot \hat{n}$
D)$\rho_b = \vec{\nabla} \cdot \vec{P} \& \sigma_b = \vec{P} \cdot \hat{n}$

7. Gausses law in presence of dielectric is
A)$\vec{\nabla} \cdot \left(\varepsilon_0 \vec{E} - \vec{P}\right) = \rho_f$
B) $\vec{\nabla} \cdot \left(\varepsilon_0 \vec{E} + \vec{P}\right) = \rho_f$
C)$\vec{\nabla} \cdot \left(E - \varepsilon_0 \vec{P}\right) = \rho_f$
D)$\vec{\nabla} \cdot \left(\vec{E} + \varepsilon_0 \vec{P}\right) = \rho_f$

8. The dielectric constant of methanol is 33 and electric susceptibility is 32 kept in external filed of 200v/m. Find the polarization.
(Given: Permittivity of free space=$8.85 \times 10^{-12} C^2/Nm^2$)
A) $5.66 \times 10^8 C/m^2$
B) $5.66 \times 10^{-8} C/m^2$
C) $5.66 \times 10^{-8} m^2/C$
D)$5.66 \times 10^8 m^2/C$

9. _____ is called Ampère's law (in differential form).
A)$\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$
B)$\vec{B} = \mu_0 \vec{J}$
C)$\vec{\nabla} \cdot \vec{B} = \mu_0 \vec{J}$
D)$\vec{\nabla} \cdot \vec{B} = \vec{J}$

10. If I_{enc} (the current enclosed by the Amperian loop) ,then $\oint B \cdot dl$ = _____.
A)$2\mu_0 I_{enc}$
B) $\mu_0 I_{enc}$
C) $2\mu_0 I$
D) $-\mu_0 I$

In magnetized material potential of volume current and potential of surface current densities are

11. defined respectively as _____.

A)$\overrightarrow{J_b} = \vec{\nabla} \times \vec{M}$ and $\overrightarrow{K_b} = \vec{\nabla} \times \hat{n}$
B)$\overrightarrow{\rho_b} = \vec{\nabla} \times \vec{M}$ and $\overrightarrow{\sigma_b} = \vec{\nabla} \times \hat{n}$
C)$\overrightarrow{J_b} = -\vec{\nabla} \times \vec{M}$ and $\overrightarrow{K_b} = \vec{\nabla} \times \hat{n}$
D)$\overrightarrow{\rho_b} = \vec{\nabla} \times \vec{M}$ and $\overrightarrow{\sigma_b} = -\vec{\nabla} \times \hat{n}$

12. The Amperes law (in integral form) inside magnetized material is given as _____.
A) $\oint \vec{\nabla} \times \vec{H} = \overrightarrow{J_f}$
B) $\oint \vec{H} \times dl = \overrightarrow{J_f}$
C) $\oint \vec{H} \cdot dl = \overrightarrow{I_f}$
D) $\oint \vec{\nabla} \cdot \vec{H} = \overrightarrow{I_f}$

13. The correct relationship between $\vec{B}$ and $\vec{H}$ is given as _____.
A) $\vec{B} = \mu_0(1 - \chi_m)\vec{H}$
B) $\vec{B} = \mu_0(1 + \chi_m)\vec{H}$
C) $\vec{H} = \mu_0(1 + \chi_m)\vec{B}$
D)$\vec{H} = \mu_0(1 - \chi_m)\vec{B}$

14. Maxwell's correction term to the Ampere's law is _____.
A) $+\mu_0\varepsilon_0\frac{\partial E}{\partial t}$
B)$-\mu_0\varepsilon_0\frac{\partial E}{\partial t}$
C)$+\mu_0\varepsilon_0\frac{\partial B}{\partial t}$
D)$-\mu_0\varepsilon_0\frac{\partial B}{\partial t}$

15. For steady currents $\vec{\nabla} \cdot \vec{J}$ is _____.
A) Imaginary
B) zero
C) Infinite
D) non-zero

16. When the polarization of the dielectric changes there is motion of the bound surface charges which results in _____.
A) Bound current
B) Magnetic current
C) Free current
D) Polarisation current

17. The expression for continuity equation is _____.

A) $\overline{\nabla}.\bar{J} + \frac{\partial \rho}{\partial t} = 0$

B) $\overline{\nabla}.\bar{J} - \frac{\partial \rho}{\partial t} = 0$

C) $\overline{\nabla}.\bar{\rho} + \frac{\partial \vec{J}}{\partial t} = 0$

D) $\overline{\nabla}.\bar{\rho} - \frac{\partial \vec{J}}{\partial t} = 0$

18 Poynting theorem is principle of conservation of _____.

A) current

B) charge

C) energy

D) momentum

19 Energy density in electromagnetic field is _____.

A) $\frac{\varepsilon_0 E^2}{2} - \frac{B^2}{2\mu_0}$

B) $\frac{\varepsilon_0 E^2}{2} + \frac{B^2}{2\mu_0}$

C) $\frac{E^2}{2\varepsilon_0} + \frac{B^2}{2\mu_0}$

D) $\frac{E^2}{2\varepsilon_0} + \frac{2B^2}{\mu_0}$

20 ---------- is the Poynting vector of electromagnetic waves.

A) $\frac{\bar{E} \times \bar{B}}{\mu_0}$

B) $\frac{\bar{E} \,.\, \bar{B}}{\mu_0}$

C) $\frac{\bar{E} \times \bar{B}}{\varepsilon_0}$

D) $\frac{\bar{E} \times \bar{B}}{\mu_0 \varepsilon_0}$