



UNIVERSITY OF THE PUNJAB

B.S. 4 Years Program :Third Semester – 2020

Paper: Physics-III (Electricity & Magnetism)

Course Code: PHY-211/21307Part – I (Compulsory)

Time: 15Min. Marks: 10

Roll No. in Fig.

Roll No. in Words.

Attempt this Paper on this Question Sheet only.

Division of marks is given in front of each question.

This Paper will be collected back after expiry of time limit mentioned above.

Signature of Supdt.:

Q.1. Encircle the right answer cutting and overwriting is not allowed. (10x1=10)

- (i) The electric field due to a uniform distribution of charge on a spherical shell is zero:
(a) everywhere (b) only at the center of the shell
(c) only inside the shell (d) only outside the shell
- (ii) If both the plate area and the plate separation of a parallel-plate capacitor are doubled, the capacitance is:
(a) unchanged (b) doubled (c) halved (d) tripled
- (iii) In a purely capacitive circuit the current:
(a) leads the voltage by one-fourth of a cycle (b) leads the voltage by one-half of a cycle
(c) lags the voltage by one-fourth of a cycle (d) lags the voltage by one-half of a cycle
- (iv) The quantity $(1/2) \epsilon_0 E^2$ has the significance of:
(a) energy / farad (b) energy / coulomb (c) energy / volume (d) energy / volt
- (v) If \vec{J} is the current density and $d\vec{A}$ is a vector element of area then the integral $\int \vec{J} \cdot d\vec{A}$ over an area represents:
(a) the flux through the area (b) the resistance of the area
(c) the resistivity of the area (d) the current through the area
- (vi) Lines of the magnetic field produced by a long straight wire carrying a current:
(a) are in the direction of the current (b) are opposite to the direction of the current
(c) are circles concentric with the wire (d) leave the wire radially
- (vii) Faraday's law states that an induced emf is proportional to:
(a) the rate of change of the magnetic flux (b) the rate of change of the magnetic field
(c) the rate of change of the electric field (d) the rate of change of the electric flux
- (viii) Which of the following quantities increases with increasing frequency?
(a) R (b) L (c) X_L (d) X_C
- (ix) The dimensions of the product $\epsilon_0 \mu_0$ are related to those of velocity as:
(a) (velocity)² (b) velocity (c) 1/ velocity (d) 1/(velocity)²
- (x) For an electromagnetic wave the direction of the vector $\vec{E} \times \vec{B}$ gives:
(a) the direction of the electric field (b) the direction of the magnetic field
(c) the direction of wave propagation (d) the direction of the emf induced by the wave



ATTEMPT THIS (SUBJECTIVE) ON THE SEPARATE ANSWER SHEET PROVIDED

Q.2. Give short answers of the following: (10x2=20)

- i. Is there a net force on an electric dipole placed in a non-uniform electric field?
- ii. In the median plane of an electric dipole, is the electric field parallel or antiparallel to the electric dipole moment \vec{p} ?
- iii. What is meant by an electric field of continuous charge distribution?
- iv. Define the term “motional EMF”.
- v. What is the effect of dielectric on the capacitance of capacitors?
- vi. State Lenz’s law.
- vii. You are given a length ℓ of copper wire. How would you arrange it to obtain maximum inductance?
- viii. Why is Maxwell’s modification of Ampere’s law needed to understand the propagation of electromagnetic waves?
- ix. What is Poynting vector? Write down its mathematical form.
- x. What do you mean by *doping*?

Give brief answers of the followings. (3x10=30)

- Q.3: (a) Derive an expression for the electric field intensity at a point on the axis of a circular plastic disk of radius R carrying a uniform charge density σ .
- (b) A plastic rod, whose length L is 220 cm and whose radius r is 3.6 mm, carries a negative charge q of magnitude $3.8 \times 10^{-7} C$, spread uniformly over its surface. What is the electric field near the midpoint of the rod, at a point on its surface?
(6, 4)
- Q.4: (a) Discuss the growth of current in an LR series circuit.
- (b) Derive an expression for the torque acting on a rectangular loop of wire carrying a current i , placed in a uniform magnetic field and capable of rotation about an axis perpendicular to the field.
(5, 5)
- Q.5: (a) What are Maxwell’s equations? Write down their mathematical forms.
- (b) A parallel-plate capacitor having two circular plates of radius R is being charged. Considering the case of $r \leq R$, derive an expression for the induced magnetic field at radius r in the region between the plates.
(5, 5)