



COMSATS University Islamabad (CUI), Islamabad Campus
Terminal Examination Spring 2025

Class : BCT-2

Subject: Applied Physics

Instructor: Tahir Nazir

Date: June 23, 2025

Time Allowed: Three hours

Marks: 100

Instructions:-

- Attempt all questions.
- Don't try to write unnecessary details, it will be considered as negative point.
- Carrying of digital diaries is not allowed.
- Mobile phones are not allowed in the examination hall.

Q.1. Fill in the blanks.

(20)

- 6.25×10^{17} electrons are there in one coulomb of negative charge.
- The net electric flux through a closed surface that surrounds no charge is 0 .
- If a charged particle is located inside a shell of uniform charge, there is no net E on the particle from the shell.
- For ohmic samples a reversal of the potential difference simply reverse the V without changing its R .
- The magnitude of the emf induced in a conducting loop is equal to the rate at which the Φ through that loop changes with time.
 $E = \frac{\Delta \Phi}{\Delta t}$

Q.2. (a) Each of two small spheres is charged positively, the total charge being $52.6 \mu\text{C}$. Each sphere is repelled from the other with a force of 1.19 N when the spheres are 1.94 m apart. Calculate the charge on each sphere.
 12.06×10^{-4}

(b) An infinite line of charge produces a field of magnitude $4.5 \times 10^4 \text{ N/C}$ at distance 2 m . Find the linear charge density.
 $E = \frac{\lambda}{2\pi\epsilon_0 r}$

Q.3. (a) Suppose that in a lightning flash the potential difference between a cloud and the ground is $1 \times 10^9 \text{ V}$ and the quantity of charge transferred is 30 C . (i) What is the change in energy of that transferred charge? (ii) If all the energy released could be used to accelerate a 1000 kg car from rest, what would be its final speed?
 2×10^{14}
 $\Delta U = q \times V$

(b) A beam contains 2×10^8 doubly charged positive ions per cubic centimeter, all of which are moving north with a speed of $1 \times 10^5 \text{ m/s}$. What are the (i) magnitude and (ii) direction of the current density J ?
(iii) What additional quantity do you need to calculate the total current I in this ion beam?

Q.4. (a) A surveyor is using a magnetic compass 6.1 m below a power line in which there is a steady current of 100 A . (i) What is the magnetic field at the site of the compass due to the power line? (ii) Will this field interfere seriously with the compass reading? The horizontal component of Earth's magnetic field at the site is $20 \mu\text{T}$.
 $B = \frac{\mu_0 I}{2\pi r}$
 $3.31 \times 10^{-6} \text{ T}$

(b) A solenoid 1.30 m long and 2.60 cm in diameter carries a current of 18 A . The magnetic field inside the solenoid is 23 mT . Find the length of the wire forming the solenoid.
 $B = \frac{\mu_0 n I}{L}$
 1.27×10^{-4}

Q.5. (a) A long solenoid has a diameter of 12 cm. When a current i exists in its windings, a uniform magnetic field of magnitude $B = 30$ mT is produced in its interior. By decreasing i , the field is caused to decrease at the rate of 6.50 mT/s. Calculate the magnitude of the induced electric field (i) 2.20 cm and (ii) 8.20 cm from the axis of the solenoid.

(b) As a parallel-plate capacitor with circular plates 20 cm in diameter is being charged, the current density of the displacement current in the region between the plates is uniform and has a magnitude of 20 A/m².

(i) Calculate the magnitude B of the magnetic field at a distance $r = 50$ mm from the axis of symmetry of this region. (ii) Calculate dE/dt in this region.

$$2.37 \times 10^{-3}$$

$$E \cdot ds =$$

$$7.5 \times 10^{-5}$$

$$3.9 \times 10^{-4}$$

$$B = \frac{\mu_0 i}{2\pi r}$$

$$(10, 10)$$

$$1.2 \times 10^{-4}$$