



COMSATS Institute of Information Technology, Islamabad Campus
Terminal Examination, FALL 2014

Class: BET-1B

Date: January 10, 2014

Subject: Applied Physics for Engineers (PHY121)

Time Allowed: 3 Hours

Instructor: Dr. Farrakh Shahzad

Marks: 50

- Attempt all questions.
- Carrying of digital diaries is not allowed.
- Mobile phones are not allowed in the examination hall.

Q1

(4+3+3)

- What is Gauss' law? How this law can be applied to cylindrical and spherical symmetries?
- An electron is released 9 cm from a very long nonconducting rod with a uniform $6 \mu\text{C/m}$.
What is the magnitude of the electron's initial acceleration? $F = ma$, $a = \frac{F}{m}$, $F = qE$ charge density
- Wearing a metal bracelet in a region of strong magnetic field could be hazardous. Explain?

Q2

(4+3+3)

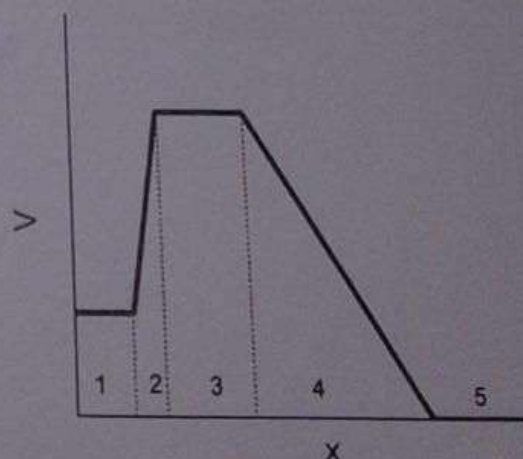
- A circular plastic disk of radius 'R' that has a positive surface charge of uniform density ' σ ' on its upper surface. Derive a relation to find the electric field at point 'P', a distance 'z' from the disk along its central axis?
 $E = k \frac{\sigma d}{z^3}$

- The electric potential at any point on the central axis of a uniformly charged disk is given by following equation:

$$V = \frac{\sigma}{2\epsilon_0} (\sqrt{z^2 + R^2} - z) \rightarrow \text{Find } E$$

Starting with this expression, derive an expression for the electric field at any point on the axis of the disk?

- Figure shows the plot of electric potential 'V' as a function of 'x'. Rank the five regions according to the magnitude of the x component of the electric field within them, greatest first?
 $2 > 4 > 1 = 3 = 5$



Q3

- a) What is Hall Effect? Derive a relation to find the charge carriers density in a conductor?
- b) A strip of copper 150 mm thick and 4.5 mm wide is placed in a uniform magnetic field $\vec{B}$ of magnitude 0.65 T, with $\vec{B}$ perpendicular to the strip. A current $i = 23$ A is then sent through the strip such that a Hall potential difference V appears across the width of the strip. Calculate V ? (The number of charge carriers per unit volume for copper is 8.47×10^{28} electrons/m³).
- c) Explain why two parallel wires carrying currents in opposite directions repel each other.

Q4

- a) What is Ampere's law? Apply this law to find magnetic field inside a long straight wire with current?
- b) A toroid having a square cross section, 5 cm on a side, and an inner radius of 15 cm, has 500 turns and carries a current of 0.8 A (It is made up of a square solenoid—instead of a round one—bent into a doughnut shape.) What is the magnetic field inside the toroid at (a) the inner radius and (b) the outer radius?
- c) Describe the similarities between Ampère's law in magnetism and Gauss's law in electrostatics.

Q5

- a) Explain the conditions for maxima and minima in young's double slit interference experiment? $\text{Max} = d \sin \theta = m\lambda$ $\text{minima} = d \sin \theta = (m + \frac{1}{2})\lambda$
- b) Two light waves are represented by the rays with wavelength 550 nm enters two different media. They also have equal amplitudes and are in phase. Medium 1 is just air, and medium 2 is a transparent plastic layer of index of refraction 1.60 and thickness 2.60 mm. What is the phase difference of the emerging waves in wavelengths, radians, and degrees? What is their effective phase difference (in wavelengths)? If the waves reached the same point on a distant screen, what type of interference would they produce? Destructive
- c) Explain why two flashlights held close together do not produce an interference pattern on a distant screen?

$$4 \times 10^{-7}$$

Coherent