

NOVEMBER 2023
EBS 408
ELECTRICITY AND MAGNETISM THEORY
1 HOUR 20 MINUTES

Candidate's Index Number
Signature:

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

COLLEGES OF EDUCATION
FOUR-YEAR BACHELOR OF EDUCATION (B.ED)
FOURTH YEAR, END-OF-SECOND SEMESTER EXAMINATION, NOVEMBER 2023

8TH NOVEMBER 2023 ELECTRICITY AND MAGNETISM THEORY 9:40 AM – 11:00 AM

SECTION B
[40 MARKS]

Answer TWO questions from this Section.
Please, note that if you answer more than two questions, only the first two will be marked.

1.
 - a.
 - i. State *Lenz's law*. [4 marks]
 - ii. Sketch the graph of voltage and current across an inductor as a function of time for purely inductive circuit. [3 marks]
 - b. An air-core solenoid with 2000 loops is 60 cm long and has a diameter of 2.0 cm. If a current of 5.0 A is sent through it, what will be the flux density within it? [8 marks]
 - c. What is *Superconductivity* and what are the characteristics of *superconductors*? [5 marks]

2.
 - a.
 - i. Define the term *Magnetic flux Density*. [4 marks]
 - ii. Determine the magnetic flux through the surface of rectangular loop with dimensions 0.70 m and 0.90 m if the field is 0.02 T at an angle 45°. [8 marks]
 - b. Give **two** examples of *ferromagnetic materials*. [4 marks]
 - c. What is the essence of the soft iron core of a transformer? [4 marks]

3.

- a. State **three** uses of *electromagnets*. [3 marks]
- b. An a.c. circuit consists of a 250Ω resistor and a $10 \mu\text{F}$ capacitor connected in series with an alternating source 240 V , 80 Hz . Calculate the;
- i. capacitive reactance of the circuit. [4 marks]
 - ii. voltage across the capacitor. [9 marks]
- c. Explain any two applications of Biot-Savart law. [4 marks]

4.

- a.
- i. What is *Hall effect*? [3 marks]
 - ii. An ion passes through a velocity selector whose mutually perpendicular electric and magnetic field are $E = 2.0 \times 10^4 \text{ Vm}^{-1}$ and $B = 0.10 \text{ T}$ respectively. Determine the speed of the ion. [3 marks]
- b. An alpha (α) particle enters at right angles, a uniform magnetic field of 0.2 T with a speed of $4.0 \times 10^{15} \text{ ms}^{-1}$. Calculate the magnitude of the;
- i. magnetic force on the particle. [7 marks]
 - ii. acceleration of the particle. [7 marks]

[mass of alpha particle = $6.4 \times 10^{-27} \text{ kg}$; charge of an alpha particle = $3.2 \times 10^{-19} \text{ C}$]