

NOVEMBER 2023
EBS 408
ELECTRICITY AND MAGNETISM THEORY
2 HOURS

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 9:00 AM – 9:40 AM

This paper consists of two sections, A and B. Answer ALL the questions in Section A and TWO questions from Section B. Section A will be collected after the first 40 minutes.

SECTION A
[20 MARKS]

Answer ALL the questions in this Section.

Items 1 to 20 are stems followed by four options lettered A to D. Read each item carefully and circle the letter of the correct or best option.

- The angle between the geographic north and the magnetic north is called
 - angle of declination.
 - angle of dip.
 - Angle of variation.
 - magnetic meridian.
- The region around a magnet where the magnetic influence is felt is called magnetic
 - domain.
 - field.
 - flux.
 - pole.
- What is the electric field intensity at a point where a force of 2 N is acting on the charge 6 μC at that point?
 - $3.00 \times 10^{-6} \text{ N/C}$
 - $3.33 \times 10^{-4} \text{ N/C}$
 - $3.33 \times 10^{-5} \text{ N/C}$
 - $3.30 \times 10^5 \text{ N/C}$

4. When a bar magnet was placed near a circular coil having 50 turns, the magnetic field density changed at a rate of 0.10 T/s. Find the emf induced in the coil.
- A. 0.5 V
 - B. 10 V
 - C. -10 V
 - D. -0.5 V
5. The ability of a living organism to sense a magnetic field is called
- A. biomagnetism.
 - B. electrosensation.
 - C. magnetoception.
 - D. zyptomagchrome.
6. A 0.1 T magnet has a field that points upwards. The pole faces have a diameter of 2.0 cm. Find the force on 5.0 A current flowing eastwards.
- A. 0.01 N
 - B. 0.10 N
 - C. 1.00 N
 - D. 1.01 N
7. Which of the following does **not** explain why the earth's magnetic field is beneficial to life on earth?
- A. Location of position on the high sea by surveyors.
 - B. Protection of the earth from harmful cosmic rays and solar winds emitted by the sun.
 - C. Transmission of radio waves by radio transmitters.
 - D. Use of magnetic dip by turtles for navigation.
8. Considering motional electromotive force, what is the relationship between electric field (E), velocity of the conductor (v) and the magnetic field (B)?
- A. $B = v/E$
 - B. $B = vE$
 - C. $E = v/B$
 - D. $E = vB$
9. Which electric machine produces electric energy as a coil moves in a magnetic field?
- A. Cathode-ray tube
 - B. Generator
 - C. Motor
 - D. Transformer
10. How does an inductor behave in a circuit? It
- A. allows alternating current (AC) to pass easily.
 - B. blocks direct current (DC).
 - C. Opposes any change in the amount of current flowing.
 - D. Stores energy in electric field.
11. What is the characteristic property of a superconductor?
- A. Conductor that allows infinite amount of current when its temperature rises above a certain value.
 - B. Material that allows current to pass through at high temperature.
 - C. Material that loses its electrical resistance when its temperature falls below a certain value.
 - D. Material whose conductivity decreases with temperature.

12. The temperature below which metals exhibit zero resistivity and turns into a superconductor is called the temperature.
- absolute
 - ambient
 - critical
 - triple point
13. If I is the current in a conductor of length l which is placed at right angle to a magnetic field of flux density B , the force F experienced by the conductor is given by
- $F = B^2 Il$
 - $F = BI^2 l$
 - $F = BIl^2$
 - $F = BIl$
14. A $10 \mu\text{C}$ charge moves with a velocity of $1.0 \times 10^5 \text{ ms}^{-1}$ at right angle to a uniform magnetic field of flux density 0.5 T . Calculate the force on the charge due to the field.
- 0.5 N
 - $5.0 \times 10^5 \text{ N}$
 - $5.0 \times 10^6 \text{ N}$
 - 5.0 N
15. A long straight conductor carries a 1.0 A current. At what distance from the axis of the conductor does the resulting magnetic field has magnitude $B = 0.5 \times 10^{-4} \text{ T}$?
[Permeability of free space = $4\pi \times 10^{-7} \text{ T.m/A}$]
- $4 \times 10^{-11} \text{ m}$
 - $4 \times 10^{-2} \text{ m}$
 - $4 \times 10^{-7} \text{ m}$
 - $4 \times 10^{-3} \text{ m}$
16. The magnitude of the force, F on charge is written as $F = qvB\sin\theta$. The angle is between the
- field lines and the field strength.
 - field lines and the velocity.
 - velocity and the field strength.
 - velocity and the force.
17. Which of the following instruments employs the Faraday's law in its operation?
- Dynamo
 - Electroscope
 - Galvanometer
 - Motor
18. The primary coil of a transformer has 3000 turns. If the transformer is required to give 20 V from a 240 V mains supply, calculate the number of turns of the secondary.
- 25
 - 150
 - 250
 - 3600

19. A $20\ \mu\text{F}$ capacitor and a $50\ \Omega$ resistor are connected in series across a $230\ \text{V}$, $50\ \text{Hz}$ a.c supply. Calculate the impedance of the circuit.
- A. $131.4\ \Omega$
 - B. $151.1\ \Omega$
 - C. $159.2\ \Omega$
 - D. $166.8\ \Omega$
20. What does the expression, $\frac{1}{2}LI^2$, mean?
- A. Capacitive reactance.
 - B. Energy stored in magnetic field of an inductor.
 - C. Inductive current.
 - D. Inductive reactance.