

BOWEN UNIVERSITY, IWO. OSUN STATE. NIGERIA

COLLEGE OF AGRICULTURE, ENGINEERING, AND SCIENCE

PHYSICS PROGRAMME

SECOND SEMESTER EXAMINATION, 2022/2023 SESSION

PHY 352: ELECTROMAGNETIC FIELDS

(2 CREDITS)

DATE: MONDAY, 19TH JUNE, 2023

TIME: 8:30 A.M – 10:30 A.M

INSTRUCTION: ATTEMPT ANY THREE QUESTIONS

(Each question carries 33 marks, 1 mark for clear presentation)

.....
Use the following constants where applicable.

Velocity of light = 3.00×10^8 m/s

Charge on an electron $e = 1.6 \times 10^{-19}$ C,

1u (atomic mass unit) = 1.66×10^{-27} kg,

1 eV = 1.602×10^{-19} J

Coulomb's constant (k) = 8.9876×10^9 kgm³s⁻²C

rest mass of electron = 1.008665u

rest energy equivalent (1u) = 931.494 MeV/u,

mass of electron $m_e = 9.1 \times 10^{-31}$ kg

Permittivity of free space $\epsilon_0 = 8.8542$ C/Nm

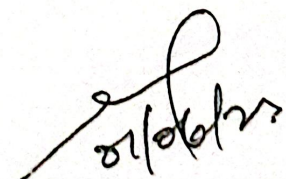
Permeability of free space $\mu_0 = 1.257 \times 10^{-6}$ Hm⁻¹
.....

QUESTION 1

- A. State and explain in details Coulomb's law in electromagnetism. (11 marks)
- B Discuss (i) three (3) areas where Coulomb's law can be applied. (6 marks)
- (ii) three (3) situations where Coulomb's law may not be valid. (6 marks)
- C. (i) Calculate the electric field strength at a distance of 2.0 m from a point charge of $10 \mu\text{C}$? (5 marks)
- (ii) Two point charges, $-4.0 \mu\text{C}$ and $+6.0 \mu\text{C}$, are separated by a distance of 0.30 m. Calculate the electric potential energy of the system. (5 marks)

QUESTION 2

- A. Write short notes on the following:
- (i) Electric dipole moment; and (6 marks)
- (ii) Potential dipole moment. (5 marks)
- B Explain the following:
- (i) dielectric; and (6 marks)
- (ii) capacitance. (6 marks)



- C. (i) Calculate the potential dipole moment of a molecule with a charge of 2.5×10^{-9} C separated by a distance of 2.0×10^{-10} m. (5 marks)

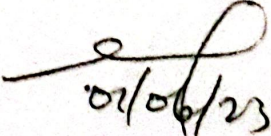
(ii) Calculate the capacitance of a parallel plate capacitor with an area of 0.05 m^2 and a plate separation of 0.002 m , filled with a dielectric material with a relative permittivity of 2.5 . (5 marks)

QUESTION 3

- A. (i) State and explain the Ampere's law. (4 marks)
(ii) What is the significance of the law? (6 marks)
- B. (i) State three applications of Ampere's law. (6 marks)
(ii) Give the conditions for the applications mentioned in question b(i). (6 marks)
- C. Calculate the magnetic field at a distance of 3 cm from a long, straight wire carrying a steady current of 5 A . The wire has a radius of 2 mm . (11 marks)

QUESTION 4.

- A. Write out Maxwell's equations in;
(i) differential form, and (4 marks)
(ii) integral form. (4 marks)
- B. Describe the equations and state the physics laws each of these equations were derived from. (12 marks)
- C. (i) Give one important consequence of Maxwell's equations? (1 mark)
(ii) Describe the correctional factor added by Maxwell to Ampere's equation that makes it valid to be used. (12 marks)


01/06/23