BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF SCIENCE EDUCATION

DEPARTMENT OF ENGINEERING AND PHYSICS

BACHELOR OF SCIENCE (HONS) DEGREE IN ELECTRONIC ENGINEERING

EEE3201 ELECTROMAGNETIC THEORY

TIME: 3 HOURS

MAY 2024

INSTRUCTIONS TO CANDIDATES

1. The paper consists of SEVEN (7) questions.
2. Answer any FIVE questions.
3. Each question carries 20 marks.

ADDITIONAL MATERIALS

- Non-programmable calculator.

QUESTION 1

a. Briefly explain dielectric strength. [4]

b. State and explain the applications of Gauss law in electrostatics. [10]

c. In a material for which conductivity is 5 siemens/m and r=1 and E=250 sin 1010t (V/m). Calculate the conduction and displacement current densities . [6]

QUESTION 2

a. Give a detailed explanation on plane waves in lossy and lossless dielectrics . [10]

b. A point charge Q = 30nC is located at the origin in cartesian coordinates. Calculate the flux density D at (1,3, -4) m. [5]

c. Distinguish between field theory and circuit theory. [5]

Question 3

a. The capacitance of the conductor formed by the two parallel metal sheets, each 100cm^2 in area separated by a dielectric 2mm thick is 2×10^{-10} micro farad and a potential of 20KV is applied to it. Calculate:

i. Electric flux. [3]

ii. Potential gradient in kV/m. [3]

iii. The relative permittivity of materials. [3]

iv. Electric flux density. [3]

a. With the aid of diagrams explain the difference between polarized and non-polarized electric field. [8]

Question 4

a. With the aid of equations show the relationship between **magnetic flux density** and **field intensity.** [8]

b. State Bio-Savarts law. [2]

c. Define the following:

i. Poynting vector. [2]

ii. Magnetization. [3]

d. Write short notes on Faraday's law of induction. [5]

Question 5

a. Derive an expression for energy stored and energy density in magnetic field. [9]

b. State Lenz's law. [3]

c. With the aid of diagrams and equations, give any three coordinates systems. [8]

Question 6

a. Briefly explain any five properties of electric lines of force. [10]

b. Three-point charges Q1 = 50nC, Q2 = 120nC and Q3 = -60nC, are enclosed by surface. Calculate the net flux. [3]

c. Define the following terms:

i. Polarization. [3]

ii. Current density. [2]

iii. Dielectric strength. [2]

Question 7

a. Explain why rectangular waveguides are preferred over circular waveguides . [5]

b. State and proof divergence theorem. [9]

c. State the following:

i. Coulomb's law. [3]

ii. Ampere's circuital law. [3]