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Code No: 154AV

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech II Year II Semester Examinations, February -2024

ELECTROMAGNETIC FIELDS AND WAVES

(Electronics and Communication Engineering)

Time: 3 Hours

Max. Marks: 75

Note: i) Question paper consists of Part A, Part B.

ii) Part A is compulsory, which carries 25 marks. In Part A, answer all questions.

iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

PART – A

(25 Marks)

- 1.a) Define conduction current. [2]
- b) Write the relation between electric field intensity and electric potential. [3]
- c) State Biot – Savarts law. [2]
- d) Write Maxwell's Two Equations for Magneto static Fields. [3]
- e) What are the conditions at a boundary surface of dielectric-dielectric? [2]
- f) Explain the Inconsistency of Displacement Current Density. [3]
- g) Define polarization. [2]
- h) Write the differences between the conductors and insulators. [3]
- i) Define group velocity. [2]
- j) Write the wave equation in rectangular coordinates. [3]

PART-B

(50 Marks)

- 2.a) Explain in detail about Equation of continuity.
- b) Calculate the force on a unit positive charge at $P(x=2m, y=0)$ due to the charges Q_1 at origin and Q_2 at $(x=1m, y=0)$ where $Q_1 = 1000$ Pico coulombs $Q_2 = -2000$ Pico coulombs. [5+5]

OR

- 3.a) State and explain about Gauss's law.
- b) Two point charges $Q_1 = 2nC$, $Q_2 = 4 nC$ are located at points $(1,1,1)$ and $(1,0,0)$ respectively. Determine the potential at point $(1,1,0)$. [5+5]

- 4.a) Explain briefly about Magnetic Scalar and Vector Potentials.
- b) State Ampere's circuital law and explain any two applications of Ampere's circuital law. [5+5]

OR

- 5.a) State and explain Ampere's Force Law.
- b) If the magnetic field, $H = r \sin \phi a_r + 2.5 r \sin \theta \cos \phi a_\phi$ A/m exists in a Medium whose $\mu_r = 3.0$, find the magnetic flux density. [5+5]

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- 6.a) State and explain faraday's laws of electromagnetic induction.
b) Obtain an expression for the Displacement current density. [5+5]

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7. State and explain Maxwell's equations in differential and integral form? [10]

- 8.a) State and prove Poynting theorem.
b) Obtain the relation between E & H? [5+5]

OR

9. Explain about the motion of uniform plane wave in free space and Dielectrics with necessary equations. [10]

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- 10.a) Develop the relationship between group velocity and phase velocity for a rectangular wave guide.
b) Derive the field component for TE waves in a metal rectangular waveguide. [5+5]

OR

- 11.a) Explain why the wavelength in a rectangular waveguide is greater than the free space wavelength.

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- b) A rectangular wave guide measures $2\text{ cm} \times 2.5\text{ cm}$. Determine the cutoff wave length, cut off frequency for the dominant TE mode. [5+5]

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