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Code No: 155SE

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD

B. Tech III Year I Semester Examinations, March - 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)	Write the applications of Gauss Law.	[2]
b)	What is the difference between convection and conduction currents?	[3]
c)	What is magnetic scalar potential?	[2]
d)	State and explain Ampere's force law.	[3]
e)	What is the significance of Maxwell's equations?	[2]
f)	Describe briefly the inconsistency of Ampere's law.	[3]
g)	What are the features required for wave propagation in good conductors?	[2]
h)	Define poynting theorem and give its equations.	[3]
i)	Write the wave equation in rectangular coordinates.	[2]
j)	Define effective dielectric constant and give its equation.	[3]

PART – B

(50 Marks)

2.a) Describe the work done in moving a point charge in an electrostatic field.
b) Define potential difference and prove that it is independent on the shape of the path. [5+5]

OR

3.a) List various properties of Electric lines of Force.
b) Derive the equation for Second Maxwell's equation of electrostatics. [5+5]

4.a) Write a short notes on:
i) force on a charge particle,
ii) force on a current element.

b) An infinitely long conductor of radius 'a' is place such that its axis is along the z-axis. The vector magnetic potential, due to a direct current I_0 flowing along $\hat{a}_z$ in the conductor is given by

$$\vec{A} = -\frac{I_0}{4\pi a^2}\mu_0\left(x^2+y^2\right)\hat{a}_z \text{ Wb/m}$$

Find the corresponding $\vec{H}$. Also confirm the result using Ampere's law. [4+6]

OR

5.a) Prove that $\vec{E}$ =-gradV, where E is electric field intensity and V is electric potential.

b) Explain biot- savart's law. Find the magnetic field intensity for infinite line. [5+5]

6.a) Explain the two cases of inconsistency of ampere law for time varying fields by considering time varying fields .

b) State and explain Faradays laws. [5+5]

OR

7.a) Obtain Maxwell's equations in different forms.

b) Obtain the boundary conditions for dielectric conductor interfaces under time varying fields. [5+5]

8.a) Derive the wave equation for a perfect dielectric media.

b) Explain reflection and refraction of plane waves. [5+5]

OR

9.a) Explain the wave propagation in lossless and conducting media.

b) The vector amplitude of an electric field associated with a plane wave that propagates in the negative z direction in free space is give by $E_m=2a_x+3a_y$ V/m find the magnetic field strength. [5+5]

10.a) Write a brief note on excitation of modes in rectangular wave guides.

b) Explain wave impedance of a rectangular wave guide and derive the expression for the wave impedance of TE and TM waves. [5+5]

OR

11.a) Why circular waveguides are not preferred over rectangular wave guides?

b) Write a brief notes on excitation of mode in circular wave guides. [5+5]

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