Gandhi Institute of Engineering and Technology University, Odisha, Gunupur
(GIET University)
B. Tech (Fifth Semester - Regular) Examinations, November – 2024
22BECPC35004 –ELECTROMAGNETIC WAVES
(Electronics & Communication Engineering)

Time: 3 hrs   Maximum: 70 Marks

Answer ALL questions
(The figures in the right hand margin indicate marks)

PART – A   **(2 x 5 = 10 Marks)**

Q.1. Answer **ALL** questions

		CO	Blooms Level
a.	Find the gradient of the following scalar fields: $V = e^{-z} \sin 2x \cosh y$	CO1	K2
b.	In a medium, the electric field intensity E = 10sin(1000t-10x)a3V/m. Calculate the displacement current density ($\epsilon_r = 80$, $\epsilon_0 = 8.854 \times 10^{-12}$F/m).	CO2	K3
c.	Define Skin Depth with proper expression	CO3	K2
d.	Differentiate between phase velocity and group velocity with expressions.	CO4	K2
e.	Define skin depth.	CO4	K1

PART – B   **(15 x 4 = 60 Marks)**

Answer **All** questions

		Marks	CO #	Blooms Level
2. a.	Two dipoles with dipole moments -5az nC/m and 9az nC/m are located at points (0, 0, - 2) and (0, 0, 3), respectively. Find the potential at the origin.	8	CO1	K2
b.	If A = 10a$_x$ - 4a$_y$ + 6a$_z$ and B = 2 a$_x$ + a$_y$, find: (i) the component of A along a_y, (ii) the magnitude of 3A - B, (iii) a unit vector along A + 2B.	7	CO1	K3

(OR)

		Marks	CO #	Blooms Level
c.	A charge distribution with spherical symmetry has density.	8	CO1	K2

$$\rho_v = \begin{cases} \dfrac{\rho_0 r}{R}, & 0 \le r \le R \\ 0, & r > R \end{cases}$$

Determine E everywhere.

		Marks	CO #	Blooms Level
d.	Planes z = 0 and z= 4 carry current K= -10ax A/m and K = 10ax A/m respectively. Determine H at a) (1,1,1) b) (0,-3,10)	7	CO1	K3
3.a.	Region $0 \le z \le 2 \, m$ is occupied by an infinite slab of permable material (μ_r = 2.5). If B= 10ya$_x$ – 5xa$_y$mWb/m^2 within the slab, determine a) J b) J$_b$ c) M d) K$_b$ on $z = 0$.	8	CO2	K3
b.	Explain in detail about Biot Savarts Law with diagram and expressions.	7	CO2	K3

(OR)

		Marks	CO #	Blooms Level
c.	Explain about Faradays Law of Electromagnetic induction.	7	CO2	K3
d.	Give the analogy between Electric and Magnetic circuits. List the Maxwell equations in differential form and Integral form? Derive any two.	7	CO2	K3
4.a.	A uniform plane wave propagating in a medium has	8	CO3	K2

$$E = 2e^{-\alpha z} \sin(10^8 t - \beta z) \, a_y \, V/m$$

If the medium is characterized by $\epsilon_r = 1, \mu_r = 20,$ and $\sigma = 3\frac{mhos}{m}$, find α, β and

H.

b. A plane wave $E = E_o \cos(\omega t - \beta z)\, a$, is incident on a good conductor at z = 0. Find the current density in the conductor.   7   CO3   K2

(OR)

c. Explain with diagram about the reflection of a plane wave at normal and at oblique incidence.   8   CO3   K1

d. Write down the parameters for the plane wave in lossless dielectric, free space and good conductor   7   CO3   K1

5.a. A lossless transmission line of length 100 m has an inductance of 28μH and a capacitance of 20 nF. Find   8   CO4   K3

      i)   Phase velocity

      ii)   Characteristic impedance

      iii)   Phase constant at 100 KHz frequency

b. A lossless transmission line has characteristic impedance 50 ohm and a phase constant 3 rad/m at 10 MHz frequency. Find inductance and capacitance value.   7   CO4   K3

(OR)

c. Define lossless and distortion less transmission line with proper expressions. Derive expression for the input impedance of the transmission line   8   CO4   K2

d. Derive the equations for circuit model of a transmission line with proper diagram.   7   CO4   K1

--- End of Paper ---

$$\mathbf{E} = E_o \cos\left(\omega t - \beta z\right) \mathbf{a}_x$$