



ACE Engineering College

(An Autonomous Institution)

Question Paper Code:

EC402PC

ACE-R20

Semester End Examination II B. Tech- II Semester- AUGUST -2022 ELECTROMAGNETIC FIELDS AND WAVES ELECTRONICS AND COMMUNICATION ENGINEERING

Time: 3 Hours

Max. Marks: 70

H. T. No

Answer any 5 Questions out of 8 Questions from the following

Q.No	Question	Marks
1. a)	State and prove Gauss's law. List the limitations of Gauss's law.	7
b)	Point charges 4 mC and -3 mC are located at (2, 1, -3) and (-1, -2, 4) respectively. Calculate the electric force on a 12 nC charge located at (0, 3, 1) and the electric field intensity at that point.	7
2. a)	Derive the electric field boundary conditions between two dielectric media?	7
b)	Define capacitance? Derive the capacitance between two parallel plates separated by a dielectric medium?	7
3. a)	State and explain the Biot-Savart's law relating magnetic field produced at a point due to the current in a small elemental wire.	7
b)	Derive the boundary conditions for the tangential and normal components of Magneto static fields at the boundary between two perfect dielectrics.	7
4. a)	State and explain Faraday's law of electromagnetic induction.	7
b)	A circular loop located on $x^2 + y^2 = 9, z = 0$ carries a current of 10 A along \mathbf{a}_ϕ . Determine H at (0, 0, 4) and (0, 0, -4).	7
5. a)	State all Maxwell's equations in differential and integral form for time varying fields.	7
b)	The field intensity $\mathbf{E} = 250 \sin 10^{10} t \mathbf{V/m}$ for a field operating in the medium for which $\epsilon_r = 1$, $\sigma = 5 \text{ mho/m}$. Calculate the displacement current density and conduction current density.	7
6. a)	State and prove Poynting theorem.	7
b)	Given that $\vec{E} = 40 \cos(10^8 t - 3x) \hat{a}_y \text{ V/m}$. (i) Determine the direction of wave propagation. (ii) The velocity of the wave and the wavelength.	7
7. a)	Derive an expression for reflection and transmission coefficients when a wave is incident on a dielectric obliquely with parallel polarization.	7
b)	In a non magnetic medium has $\vec{E} = 4 \sin(2\pi \times 10^7 t - 0.8x) \hat{a}_z \text{ V/m}$, Find (i) ϵ_r , (ii) η (iii) The time average power carried by the wave.	7
8. a)	Derive the expression for cutoff frequency of TE_{mn} mode in rectangular wave guide.	7
b)	A rectangular waveguide has $a = 4 \text{ cm}$ and $b = 3 \text{ cm}$. Find all the possible modes of propagation at signal frequency of 5 GHz.	7