Name: **Enrolment No:**	

UPES

End Semester Examination, May 2024

Programme Name : B. Tech (Electronics and Communication) Semester : IV
Course Name : Engineering Electromagnetics Time: 03 hrs
Course Code : PHYS2031 Max. Marks: 100
Nos. of page(s) : 2

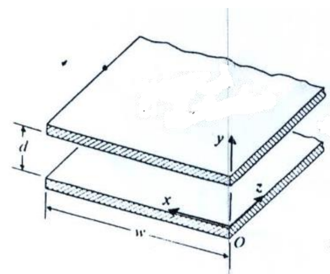
Instructions: There is one internal choice in section C. Use $\mu_0 = 4\pi \times 10^{-7}$H/m and $\epsilon_0 = 8.85 \times 10^{-12}$ F/m.

SECTION A
Answer all questions.

S. No.		Marks	CO
Q 1	State the True/False. (a) The concept of displacement current was a major contribution attributed to Maxwell. (b) Electromagnetic waves travel faster in conductor than in dielectric. (c) In a good conductor, $\vec{E}$ and $\vec{H}$ are in time phase. (d) For a lossless transmission line, the characteristic impedance does not depend on the operating frequency of the transmission line.	**4**	**CO1**
Q 2	Write the integral form of Maxwell's equations with their proper names	**4**	**CO1**
Q 3	Define the intrinsic impedance of a medium. What is the value of the intrinsic impedance of free space?	**4**	**CO2**
Q 4	Define reflection coefficient and transmission coefficient. What is the relationship between them?	**4**	**CO3**
Q 5	Compare the advantages and disadvantages of coaxial cable and two wire parallel transmission line.	**4**	**CO4**

SECTION B

Q 6	Obtain the wave equations governing the $\vec{E}$ and $\vec{H}$ fields in a source-free medium with constitutive parameters ε, μ and σ.	**10**	**CO2**
Q 7	State the Ampere's circuital law and express it in its differential form. Demonstrate its inconsistency with time-varying situations. Explain Maxwell's contribution in reconciling it with time varying situations.	**10**	**CO1**
Q 8	Find the attenuation constant, and skin depth for copper at 10000 MHz and 50 MHz. The conductivity of copper is 5.8 x 10^7 S/m and $\mu = \mu_0 = 4\pi \times 10^{-7}$H/m.	**10**	**CO2**
Q 9	A uniform plane wave in air is normally incident on an infinite lossless dielectric material having $\varepsilon = \varepsilon_0$ and $\mu = \mu_0$. If the incident wave is $\vec{E_i} = 10\cos(\omega t - z)\widehat{a_y}$ V/m., find: (a) λ and ω of the wave in air and the transmitted wave in the dielectric medium. (b) The incident $\vec{H_i}$ field (c) Γ and τ	**10**	**CO3**

SECTION C			
Q10	(a) Sketch the equivalent circuit of a differential length Δz of a two conductors transmission line. Develop the general transmission line equation express them in phasor form. (b) Show that the propagation constant of a TEM wave propagating along an infinite transmission line is given by $\gamma = \sqrt{(R + j\omega L)(G + j\omega C)}$ m^{-1}. Where L, R, G and C are the resistance per unit length, inductance per unit length, conductance per unit length and capacitance per unit length, respectively. **OR** Let us consider a y-polarized TEM wave propagating in the +z-direction along a uniform parallel plate lossless transmission line. Figure shows the cross-sectional dimension of such a line and the chosen coordinate system. In the present case the appropriate phasor solution for the wave propagating in the +z direction is $\vec{E}(z) = \widehat{a_y}\, E_y = \widehat{a_y}\, E_0 e^{-j\beta z}$  (a) Find the associated $\vec{H}(z)$ field. (b) Find the surface current density and surface charge density at upper conducting plate i.e. at y=d. (c) Develop a pair of time harmonic transmission line equations for phasors V(z) and I(z).	**20**	**CO4**
Q.11	Derive the following general expression of the attenuation and phase constant for conducting media: $$\alpha = \omega \sqrt{\frac{\mu\epsilon}{2}} \left[\sqrt{1 + \left(\frac{\sigma}{w\epsilon}\right)^2} - 1 \right]^{1/2} \quad \text{NP/m}$$ $$\beta = \omega \sqrt{\frac{\mu\epsilon}{2}} \left[\sqrt{1 + \left(\frac{\sigma}{w\epsilon}\right)^2} + 1 \right]^{1/2} \quad \text{rad/m}$$	**20**	**CO2**