Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 27-05-2025 **Time:** 09:30 am – 12:30 pm

School: SOE	**Program:** B. Tech	
Course Code: ECE3013	**Course Name:** Antenna and Wave Propagation	
Semester: VI	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**	**CO5**
Marks	**24**	**24**	**24**	**28**	**NA**

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	What is the significance of the near-field and far-field regions?	**2 Marks**	**L1**	**CO2**
2.	Write the expression for the directivity of an antenna.	**2 Marks**	**L1**	**CO2**
3.	Define Poynting vector.	**2 Marks**	**L1**	**CO1**
4.	How can you represent Faraday's Law of electromagnetic induction mathematically?	**2 Marks**	**L2**	**CO1**
5.	Define the specific element S_{ij} of the scattering matrix.	**2 Marks**	**L1**	**CO3**
6.	What type of network is represented using an ABCD matrix?	**2 Marks**	**L2**	**CO3**
7.	Which type of filter performs exactly opposite to a bandpass filter?	**2 Marks**	**L2**	**CO4**
8.	What are the two methods used to modify filter design to employ distributed elements consisting of transmission line sections?	**2 Marks**	**L1**	**CO4**
9.	What is power loss ratio?	**2 Marks**	**L1**	**CO4**
10.	What is a perfect filter?	**2 Marks**	**L1**	**CO4**

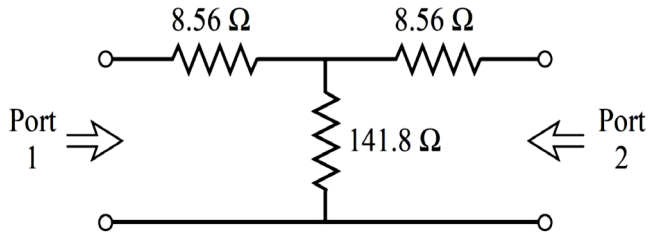
Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Write Maxwell's equations for a linear, homogeneous medium in terms of E_s and H_s, assuming only the time factor e^{-jwt}.	**10 Marks**	**L2**	**CO 1**
	b.	A plane wave propagating in the air with $E = \left(8\widehat{a_x} + 6\widehat{a_y} + 5\widehat{a_z}\right)e^{j(\omega t+3x-4y)}\ \frac{V}{m}$ is incident on a perfectly conducting slab positioned at $x \leq 0$. Find the $\vec{E}$ field of reflected wave.	**5 Marks**	**L3**	**CO 1**
	c.	The electric field of a uniform plane electromagnetic wave in the free space, along the positive x direction is given by $\vec{E} = 10(a_y + ja_z)e^{-j25x}$. Determine the frequency and polarization of the wave.	**5 Marks**	**L3**	**CO 1**
		Or			
12.	**a.**	A uniform plane wave propagating in the positive a_z direction has electric field intensity given by $E = 94.25\sin(2\pi \times 10^5 t - \beta z)\ a_z$. The medium is free space. Find the following I) Frequency of the wave II) Intrinsic impedance of the medium III) Phase constant IV) Expression for magnetic field intensity (H)	**10 Marks**	**L4**	**CO 1**
	b.	Derive the expression for attenuation constant (α) and phase constant (β) for a uniform plane wave propagating in good conductor.	**10 Marks**	**L1**	**CO 1**

13.	**a.**	Illustrate the Half Power Beam Width (HPBW) and Beam Width between First Null (BWFN) of an antenna with a suitable figure.	**5 Marks**	**L2**	**CO 2**
	b.	What are the fundamental field components of a Half-wave dipole antenna, and how do they contribute to radiation?	**5 Marks**	**L1**	**CO 2**
	c.	Derive the expressions for the electric and magnetic fields and further determine the radiated power and radiation resistance.	**10 Marks**	**L2**	**CO 2**
		Or			
14.	**a.**	How do the electric and magnetic fields of a Hertzian dipole antenna originate and propagate in space?	**10 Marks**	**L2**	**CO 2**
	b.	Derive their mathematical expressions and further determine the radiated power and radiation resistance.	**10 Marks**	**L3**	**CO 2**

15.	**a.**	Derive the expressions of voltage and current in terms of the ABCD parameters for a cascade connection.	**10 Marks**	**L3**	**CO 3**
	b.	Use signal flow graphs to find the output voltages for the following type of circuits: I. Series II. Parallel III. Self-loop IV. Split	**10 Marks**	**L3**	**CO 3**

		Or			
16.	**a.**	What is a scattering matrix? State its properties.	**5 Marks**	**L1**	**CO 3**
	b.	Given the characteristic impedance of the transmission line is 50 Ω, find the scattering matrix [S] of the network: 	**10 Marks**	**L3**	**CO 3**
	c.	Define the S-parameters for reciprocal and lossless networks.	5 Marks	L2	CO 3

17.	a.	Describe the image parameter method for microwave filter design.	15 Marks	L3	CO 4
	b.	What are periodic structures? Explain with an equivalent circuit.	5 Marks	L2	CO 4
		Or			
18.	**a.**	Describe the general procedure for filter design.	**5 Marks**	**L3**	**CO 4**
	b.	What are the different types of filter responses in the insertion loss method defined by their insertion loss, or power loss ratio?	**15 Marks**	**L2**	**CO 4**