Sub Code: R2331044B **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM

III B.Tech-I Semester (R23) Regular Examinations, November-2025

ANTENNA ANALYSIS AND DESIGN

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 hours **Max. Marks: 70**

The Question paper consists of Part A & Part B.

Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.

1		PART-A	(20Marks)
	a)	List any two historical advancements in antenna development.	[2]
	b)	Define antenna impedance.	[2]
	c)	What is a quarter-wave monopole antenna?	[2]
	d)	State the conditions for far-field region of an antenna.	[2]
	e)	What is meant by array factor?	[2]
	f)	State one application of binomial arrays.	[2]
	g)	Define Schelkunoff polynomial method.	[2]
	h)	What is meant by pattern shaping in antenna synthesis?	[2]
	i)	Mention any two common shapes of MSAs used in mobile applications.	[2]
	j)	Name two methods of analysis for MSAs.	[2]
		PART-B	(50Marks)
		Question from **Unit - I**	
2	a)	Explain the radiation mechanism of two-wire antennas.	[5]
	b)	Derive the expression for power density radiated by an isotropic antenna.	[5]
		(OR)	
3	a)	State and derive the Friis transmission equation for free-space propagation.	[5]
	b)	A horn antenna has a directivity of 15 dB and efficiency of 0.75. Calculate its gain.	[5]
		Question from **Unit - II**	
4	a)	Derive the expression for far-field components (E and H) of a small electric dipole.	[5]
	b)	Derive the expression for radiation resistance of a small electric dipole.	[5]
		(OR)	
5	a)	Derive the beam width and directivity of a half-wave dipole antenna.	[5]
	b)	Explain natural current distribution in wire antennas with examples.	[5]
		Question from **Unit - III**	
6	a)	Derive the array factor for two isotropic point sources with out-of-phase currents and draw the pattern.	[5]
	b)	State and explain the Principle of Pattern Multiplication with an example.	[5]
		(OR)	
7	a)	Explain non-uniform amplitude distributions and their effect on side lobes.	[10]
	b)	An array of 5 isotropic elements is spaced at $\lambda/4$ and fed for endfire operation. Calculate the main beam direction and draw the pattern qualitatively.	
		Question from **Unit - IV**	
8	a)	Explain the concept of antenna synthesis and its importance in modern antenna design.	[5]
	b)	List out the basic steps involved in antenna synthesis using continuous sources.	[5]

		(OR)	
9	a)	Design a 5-element array with side lobes below –25 dB using the Schelkunoff polynomial method.	[5]
	b)	Discuss any two practical applications of Fourier transform-based antenna synthesis.	[5]
		Question from **Unit - V**	
10	a)	Explain the basic requirements and challenges of antennas used for mobile communication.	[5]
	b)	Compare the performance of different feeding techniques for mobile antennas.	[5]
		(OR)	
11	a)	Explain the advantages and disadvantages of RMSAs compared to conventional MSAs.	[5]
	b)	Draw and explain the radiation pattern of a typical MSA used in mobile handsets.	[5]

Sub Code: R233104PC02 **R23** **Set No. 2**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
III B.Tech-I Semester (R23) Regular Examinations, October-2025

(ELECTRONICS AND COMMUNICATION ENGINEERING)

Time: 3 hours **Max. Marks: 70**

The Question paper consists of Part A & Part B.
Part A is compulsory, Answer all questions. Part B Answers any one question from each unit.
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1		PART-A	(20Marks)
	a)	Define beam width.	[2]
	b)	What is effective height of an antenna?	[2]
	c)	Define the effective area of an antenna.	[2]
	d)	What is a quarter-wave monopole antenna?	[2]
	e)	Define beam width of an array pattern.	[2]
	f)	What is the significance of element spacing in arrays?	[2]
	g)	State one advantage of continuous source distribution.	[2]
	h)	What is meant by pattern shaping in antenna synthesis?	[2]
	i)	Mention two key requirements for antennas used in mobile devices.	[2]
	j)	State the role of substrate thickness in MSA performance.	[2]
		PART-B	(50Marks)
		Question from **Unit - I**	
2	a)	Define the radiation mechanism in dipole antenna with neat sketch.	[5]
	b)	Find the radiation efficiency of an antenna whose radiation and loss resistances are 63Ω and 7Ω.	[5]
		(OR)	
3	a)	Define the following related to antennas (i) Gain (ii) Directivity	[5]
	b)	For an antenna operating at 900 MHz, find the effective aperture if its gain is 12 dB.	[5]
		Question from **Unit - II**	
4	a)	Derive the filed components of Half-wave dipole antenna.	[5]
	b)	Derive the radiation resistance of Half-wave dipole antenna.	[5]
		(OR)	
5	a)	State the relationship between effective area and directivity.	[5]
	b)	Describe the concept of Natural Current Distributions with neat diagrams.	[5]
		Question from **Unit - III**	
6	a)	Derive the expression for array factor of two isotropic point sources separated by distance d with uniform excitation and in-phase currents.	[5]
	b)	Derive the array factor of a uniform linear array of N isotropic elements.	[5]
		(OR)	
7	a)	A uniform linear array consists of 4 isotropic elements spaced at λ/2 with in-phase excitation. Plot its radiation pattern.	[5]
	b)	For a binomial array of 5 elements, write the amplitude coefficients and explain the resulting pattern.	[5]
		Question from **Unit - IV**	
8	a)	Describe the difference between continuous source synthesis and discrete element synthesis with examples.	[5]
	b)	Explain the basic steps involved in antenna synthesis using continuous	[5]

		sources.	
		(OR)	
9	a)	Discuss the Schelkunoff polynomial method for designing linear arrays.	[5]
	b)	Derive an expression for the far-field radiation pattern of an aperture antenna using Fourier transform synthesis.	[5]
		Question from **Unit - V**	
10	a)	Describe the characteristics of MSAs relevant to mobile communication	[5]
	b)	Explain the methods of Transmission Line Model analysis for MSAs.	[5]
		(OR)	
11	a)	Discuss the impact of substrate properties on the performance of MSAs for mobile applications.	[5]
	b)	Explain the importance of feeding position in MSAs for impedance matching.	[5]

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