Code No: RT31045 **R13** SET - 1

III B. Tech I Semester Regular Examinations, November - 2015

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	What is the radiation resistance of half wave dipole antenna?	[3M]
	b)	What are the far field conditions for an antenna?	[3M]
	c)	Discuss the merits and demerits of zoned antennas.	[4M]
	d)	Calculate PLF (dB) when polarization of incoming wave is perfectly matched to polarization of Rx antenna.	[4M]
	e)	Name the parasitic elements used in Yagi uda array. Explain their significance in array.	[4M]
	f)	In which frequency band Tropospheric scattering is used.	[4M]

PART -B

2	a)	With the help of neat diagrams explain the principle of radiation mechanism in antennas.	[8M]
	b)	A source has a constant power pattern limited to top half of the hemisphere only. Find its directivity and effective area.	[8M]
3	a)	The normalized radiation intensity of an antenna is rotationally symmetric in ϕ and it is represented by $U = \begin{cases} 1 & 0 \le \theta < 30^0 \\ 0.5 & 30^0 \le \theta < 60^0 \\ 0.1 & 60^0 \le \theta < 90^0 \\ 0 & 90^0 \le \theta < 180^0 \end{cases}$ What is the directivity (above isotropic) of antenna in dB?	[8M]
	b)	Derive the relationship between effective aperture area and gain of antenna.	[8M]
4	a)	Write short notes on: i) Collinear arrays ii) Binomial arrays and iii) Scanning arrays.	[8M]
	b)	Draw the radiation pattern of 8 – isotropic elements fed in phase, spaced $\lambda/2$ apart with the principle of pattern multiplication.	[8M]

5	a)	Derive the expression for pitch angle to get circularly polarized radiation pattern for a helical antenna, operating in broadside mode and sketch its pattern.	[8M]
	b)	Compare the requirements and radiation characteristics of resonant and non-resonant radiators?	[8M]
6	a)	List out the differences between active and passive corner reflectors.	[8M]
	b)	With reference to paraboloids, explain the following: i) f/D ratio ii) Spill over and aperture efficiency iii) Front to back ratio iv) Types of feeds.	[8M]
7	a)	Describe briefly the salient features of ground wave propagation.	[6M]
	b)	What should be the polarization of EM wave for the ground wave propagation? Justify.	[6M]
	c)	Explain the term" wave tilt of surface waves".	[4M]

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Code No: RT31045 **R13** SET - 2

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(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

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PART –A

1 a) What is the difference between directive gain and gain of antenna? [4M]

b) A transmitting antenna radiates 251W isotropically. A receiving antenna, located 100m away from the transmitting antenna, has an effective aperture of 500cm^2. Determine the total power received by the antenna. [4M]

c) For an 8ft (2.4m) parabolic dish antenna operating at 4GHz, What is the minimum distance required for far field measurement? [4M]

d) A wave traveling normally out of the page (toward the reader) has two linearly polarized components $E_x = 2\cos\omega t$ [4M]

$$E_y = 3\cos(\omega t + 90^\circ)$$

What is the axial ratio of the resultant wave?

e) What is the skip zone of a radio wave? [3M]

f) How do raindrops affect radio waves? [3M]

PART -B

2 a) What are the differences between transmission line and dipole antenna? [4M]

b) Sketch and comment on the current distributions and radiation patterns of vertical antennas of length λ/2, λ, 3λ/2, 2λ. [8M]

c) Write short notes on antenna field zones. [4M]

3 a) The power radiated by a lossless antenna is 10W. The directional characteristics of the Antenna are represented by the radiation intensity of [8M]

$$U = B_0 \cos^3\theta \left(\frac{W}{unit\ \ solid\ angle}\right) 0 \le \theta \le \frac{\pi}{2};\quad 0 \le \phi \le 2\pi .$$

Find B_0, Maximum radiation intensity and Maximum power density (W/m^2) at a distance of 1000m (assume far field distance).

b) A short antenna of height $h = l/2$ is mounted on a conducting plane. Show that its radiation resistance is one-half that of a short dipole antenna of length l and carrying the same current. [8M]

4 a) Explain the need and configuration of a folded dipole antenna. Sketch its radiation pattern and compare its characteristics with those of a simple half wave dipole. [8M]

b) Obtain the expression for the beam width of broadside and end-fire array and compare them. [8M]

5 a) Explain the salient features of Microstrip Antennas. [8M]

b) What are the advantages and limitations of Microstrip antennas? [8M]

6 a) Explain the principle of formation of images in an active corner reflector antenna. Hence sketch the image formation for a 90^o corner reflector. Obtain array factor for 90^o corner reflector. [8M]

b) What is the principle of equality of path length? How is it applicable to Horn antennas? Obtain an expression for the directivity of a pyramidal horn in terms of its aperture dimensions. [8M]

7 a) List out the modes of propagation and their frequency ranges for radio waves. Show that an approximate estimate for the magnitude of electric field strength at VHF and above is given by $\left(\frac{240I\pi h_1 h_2}{\lambda d^2}\right)$ [8M]

where I - current in the λ/2 transmitting aerial
h1, h2 - heights of Tx and Rx antennas
d - direct distance between aerials
λ - wavelength.
Specify the assumptions made for the validity of the above expression.

b) Write a short notes on: [8M]
i) MUF
ii) Virtual Height
iii) Wave tilt
iv) Multihop Transmission.

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Code No: RT31045 **R13** SET - 3

III B. Tech I Semester Regular Examinations, November - 2015

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

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2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	What is the effect of antenna's sidelobes and backlobes on its gain?	[3M]
	b)	Calculate half power beamwidth for a hertzian dipole.	[4M]
	c)	What is the directivity of isotropic antenna?	[3M]
	d)	What are the advantages of cassegrain feed in parabolic antenna?	[4M]
	e)	In which frequency range ground wave propagation is effective. Why?	[4M]
	f)	What is the difference between broad-side array and end-fire array?	[4M]

PART -B

2	a)	An infinitesimal electric dipole is centered at the origin and lies along z-axis. Find the far–zone electric and magnetic fields radiated.	[8M]
	b)	An infinitesimal electric dipole is centered at the origin and lies on the x-y plane along a line which is at an angle of 45^0 with respect to the x-axis. Find the far –zone electric and magnetic fields radiated.	[4M]
	c)	Compare monopole antennas and dipole antennas.	[4M]
3	a)	The normalized radiation intensity of a given antenna is given by $U = \sin\theta \sin\phi$. The intensity exists only in the region $0 \le \theta \le \pi, 0 \le \phi \le \pi$ and it is zero elsewhere. Find azimuthal and elevation plane half power beam widths (in degrees).	[3M]
	b)	Derive the relation between directivity and beam solid angle.	[8M]
	c)	The Electric field of a linearly polarized electromagnetic wave given by $E_i = a_x E_0(x, y) e^{-jkz}$ is incident upon a linearly polarized antenna whose electric field polarization can be expressed as $E_a = (a_x + a_y) E(r, \theta, \phi)$. Find polarization loss factor (PLF).	[5M]
4	a)	Explain the effects of uniform and non-uniform amplitude distributions in array?	[8M]
	b)	Explain how to select current excitations in an array to avoid sidelobes in radiation pattern?	[8M]

5 a) Describe the characteristics of long wire travelling wave antennas and sketch their patterns for different lengths. [8M]

b) What are the advantages of Rhombic antenna over a single wire antenna? List out the design equations associated with a Rhombic antenna. [8M]

6 a) With neat set up, explain the absolute method of measuring the gain of an antenna. [8M]

b) Discuss about Dielectric and metal Lens Antennas and their applications. [8M]

7 a) Derive the relationship between MUF and critical frequency. [8M]

b) Discuss experimental determination of virtual heights and critical frequencies. [8M]

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Code No: RT31045 **R13** SET - 4

III B. Tech I Semester Regular Examinations, November - 2015

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communication Engineering)

Time: 3 hours Max. Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B)**
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1 a) What kind of antenna polarizations must be selected to avoid probability of interference between 2 co-channel radio links? [3M]

b) What is the advantage of using helical antenna over straight wire antenna? [4M]

c) In a uniform linear array, four isotropic radiating elements are spaced λ/2 apart. What is the required progressive phase shift between the elements for forming the main beam at 60^0 off the end-fire? [4M]

d) Calculate PLF (dB) when polarization of incoming wave is orthogonal to polarization of Rx antenna. [4M]

e) What three main factors determine the amount of refraction in the ionosphere? [3M]

f) After the radiation field leaves an antenna, what is the relationship between the E and H fields with respect to (a) phase and (b) physical displacement in space? [4M]

PART -B

2 a) Define the terms: [4M]
i) Effective length
ii) Effective aperture area.

b) Calculate effective length and effective aperture area of antenna whose radiation resistance is 73 ohms. [6M]

c) Derive the expression for power radiated and find the radiation resistance of a half wave dipole? [6M]

3 a) Calculate half power beam width when $E = \frac{\cos\left[\frac{\pi(\cos\theta+1)}{4}\right]e^{-jkr}}{r} \quad 0 \le \theta \le \pi$ [3M]

b) Define reciprocity theorem and prove it in case of antenna system. [8M]

c) What is the maximum effective aperture of a microwave antenna which has a directivity of 900? [5M]

4 a) Derive the expression for the far field pattern of an array of 2 – isotropic point sources of [8M]
i) Equal amplitude and phase
ii) Equal amplitude and opposite phase
iii) Unequal amplitude and any phase.

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b) Find the radiation pattern of linear array of 4 isotropic sources spaced $\lambda/2$ apart. And sketch it. The excitations of sources are in phase and amplitude ratio 1:3:3:1. [8M]

5 a) Sketch the typical geometry of a helical antenna radiating in axial mode. List out all its parameters and basic characteristics. Write the expressions for HPBW, BWFN, directivity and axial ratio. [8M]

b) Compare the characteristics of Hertzian dipole and Hertzian Loop antenna. [8M]

6 a) What is radio horizon and optical horizon? Show that radio horizon is about 1.33 times the optical horizon. [8M]

b) What is the density of free electrons in the ionospheric layer at critical frequency of 1.3 MHz? [4M]

c) Explain the Gain comparison method for measuring the gain of an antenna. [4M]

7 a) Describe any two types of fading normally encountered in radio wave propagation. How are the problems of fading overcome? [8M]

b) Determine the change in the electron density of E-layer when the critical frequency changes from 4 MHz to 1 MHz between mid - day and sun-set. [8M]

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