Code No: R31045 **R10** **Set No: 1**

III B.Tech. I Semester Regular Examinations, November/December - 2012

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communications Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry equal marks

*****

1. Define and explain the following terms:
   (i) Directivity
   (ii) Gain
   (iii) Aperture Efficiency

(b) An antenna has a radiation resistance of 72Ω, a loss resistance of 8Ω and a power gain of 12 dB. Determine the antenna efficiency and its directivity.

2. (a) Derive the expressions for radiation fields from a vertical λ/2 radiator and hence prove that it has a radiation resistance of about 73Ω. List all the assumptions involved in it.
   (b) Define radiation resistance of an antenna. Calculate the radiation resistance of a λ/10 wire dipole in free space.

3. (a) What is a broadside array? Explain in detail the structure, radiation pattern and the principle of operation of such an antenna
   (b) For an broadside array consisting of several half wave length long isotropic radiators is to have a directive gain of 30. Find the array length and width of the major lobe.

4. (a) With a neat sketch, explain Rhombic Antennas.
   (b) Calculate in dB the directivity of 20 turn helix having $\alpha=12^0$, circumference equal to one wavelength.

5. (a) A parabolic dish provides a gain of 75 dB at a frequency of 15 GHz. Calculate the capture area of the antenna, its 3dB and null beam widths.
   (b) Define parabola. Show that by sketches how its geometry makes it a suitable basis for antenna reflectors. Why an antenna employing a paraboloid reflector is likely to be a highly directive receiving antenna? Explain.

6. (a) Explain the principle of operation of Len's antenna with neat sketches.
   (b) Calculate the index of refraction of dielectric lens formed with radial distance from centre of sphere is 0.5m and radius of sphere is 0.39m.

Code No: R31045 **R10** **Set No: 1**

7. (a) Write short notes on the following:
   (i) Maximum usable frequency
   (ii) Effect of earth's magnetic field on ionosphere propagation
   (b) A radio communication link is to be established via ionosphere. Take maximum virtual height to be 100Km at the midpoint of the path. Assume critical frequency to be $2x10^6$ Hz and distance between stations to be 600Km. Find.
   (i) Optimum working frequency
   (ii) Angle of elevation of beam

8. (a) Explain space wave propagation with its limitations.
   (b) A 150m antenna transmitting at 1.2MHz by ground wave has an antenna current of 8A. What voltage is received by the receiving antenna 40Km away, with a height of 2m.

*****

Code No: R31045 **R10** **Set No: 2**

III B.Tech. I Semester Regular Examinations, November/December - 2012

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communications Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry

*****

1. (a) Define & Give the significance of each of the following:
   i. Radiation Intensity
   ii. Effective Antenna Height
   iii. Beam efficiency
   iv. Aperture Efficiency

   (b) An isotropic antenna radiates equally in all the directions. The total power delivered to the radiator is 100 Kw. Calculate the power density at a distances of.
   (i) 100 meters. (ii) 1000 meters.

2. (a) Explain the concept of retarded scalar and vector potentials.
   (b) If maximum current in the antenna is 20 amps, find the field intensity at a distance of 2 Kms along the axis perpendicular and at an angle 30^0 from the antenna.

3. (a) Derive an expression for the array factor of two isotropic elements in.
   i. Broadside array
   ii. End fire array

   (b) A uniform linear array consisting of 16 isotropic point sources with a spacing of λ/4. If the phase difference is equal to -90^0. Calculate
   (i) HPBW , (ii)Beam solid angle (iii) Beam efficiency (iv)Directivity

4. (a) Explain the construction, operation and design consideration for a Helical antenna.
   (b) Design a helical antenna with a directivity of 15 dB that is operating in the axial mode and whose polarization is nearly circular. The spacing between the turns is λ/10. Determine the following:
   (i) Number of turns (ii) Axial ratio
   (iii) Progressive phase shifts (in degrees) between turns to achieve axial mode radiation.

5. (a) Explain the methods of feeding a paraboloid reflector in detail.
   (b) Calculate the beamwidth between first nulls & gain in dB for a 2.5m paraboloid reflector used at 6GHz.

Code No: R31045 **R10** **Set No: 2**

6. (a) Show a microwave bench setup suitable for antenna measurements. Explain how antenna gain can be measured using this bench setup. What are the precautions necessary to minimize errors in the above measurement?
   (b) While measuring gain of a horn antenna the gain oscillator was set for 9.00GHz frequency and the attenuation inserted was found to be 9.8dB. Calculate the gain of the horn if the distance between two horn was 35cm.

7. (a) Derive the expression for refractive index of ionosphere and critical frequency.
   (b) Assume that the reflection takes place at a height of 400km and maximum density corresponds to 0.9 refractive index at 10MHz. What will be the range for which MUF is 10MHz? [For flat & for curved earth]

8. (a) Explain the mechanism by which the space wave propagates. What is meant by radio horizon?
   (b) A VHF communication is established with 35W transmitter at 90MHz. Find the distance upto which the LOS communication may be possible, if the heights of Tx & Rx antennas are 40m & 25m. Also find field strength at receiving end.

*****

Code No: R31045 **R10** **Set No: 3**

III B.Tech. I Semester Regular Examinations, November/December - 2012

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communications Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry

*****

1. (a) Differentiate scattering loss aperture, collecting aperture & physical aperture of antenna.
   (b) In a microwave communication link, two identical antennas operating at 10 GHz are used with power gain of 40 dB. If the transmitter power is 1W. Find the received power, if the range of the link is 30Km.

2. (a) Explain loop antennas in detail
   (b) A grounded vertical antenna has an effective height of 113.3m and operates at a wavelength of 18.8 Km with a r.m.s. value of base current 725A. Find E and H fields at a distance of 175 Km and its power radiated.

3. (a) Briefly explain the following:
   1. Principle of pattern multiplication
   2. Binomial array

   (b) A linear broadside array consists of four equal isotropic inphase point sources with $\lambda/3$ spacing & overall length of the array is λ. Find the directivity & beam width.

4. (a) Explain different modes of operation of helical antenna in detail.
   (b) Find number of turns, turn diameter and axial ratio of right circularly polarized axial mode helical antenna with 17dB gain for operation at 1600MHz with turn spacing λ/π.

5. (a) Describe the constructional details and principles of operation of parabolic reflector. Discuss the relative merits and demerits of these antennas.
   (b) A paraboloid reflector antenna with diameter 20mts. It is designed to operate at 6GHz and illumination efficiency of 0.54. Calculate the antenna gain in decibels.

6. (a) With a neat sketch explain the different types of horn antennas. Mention merits and demerits of each type.
   (b) With the test antenna connected, the detector output meter is adjusted to read full scale or zero decibels. Now with the standard calibrated antenna connected, the output is down 7dB. If the gain of the calibrated antenna is 15dB, calculate the gain of the antenna under test.

Code No: R31045 **R10** **Set No: 3**

7. (a) Write short notes on skip distance.
   (b) At a 150km height in the ionosphere, the electron density at night is about $2x10^{12}$ m^{-3} and the signal MUF is 1.5 times the critical frequency for a transmission distance of 600Km. Compute the following:
   (i) Critical frequency (ii) Relative dielectric constant (iii) Phase constant
   (iv) Wave impedance (v) Wave velocity (vi) Group velocity (vii) Incident angle

8. (a) Explain the following:
   1. Duct propagation
   2. Path losses

   (b) Two aircrafts are flying at altitudes of 3000m and 5000m respectively. What is the minimum possible distance along the surface of the earth over which they can have effective point to point microwave communication? Radius of earth is $6.37x10^6$m.

*****

Code No: R31045 **R10** **Set No: 4**

III B.Tech. I Semester Regular Examinations, November/December - 2012

ANTENNAS AND WAVE PROPAGATION

(Electronics and Communications Engineering)

Time: 3 Hours **Max Marks: 75**

Answer any FIVE Questions

All Questions carry

*****

1. (a) Explain the following terms:
   i. Antenna effective height
   ii. Antenna aperture
   iii. Current distribution on a thin wire antenna

   (b) The radiation resistance of an antenna is 72Ω and loss resistance is 8Ω. What is the directivity in dB if the power gain is 16.

2. (a) Obtain expression for potential fields due to sinusoidally varying sources and bring out the importance of Lorentz guage condition.

   (b) An Antenna whose effective height of 100m at a frequency of 60KHz radiated 100KW of power. Determine the strength of the electric field at a distance of 100Km from the antenna. Neglect ground effect and atmospheric losses.

3. (a) Discuss the conditions under which an array of antenna will behave either as a broadside array or an end fire array.

   (b) A broadside array operating at 100cm wavelength consists of four halfwave dipoles spaced 50cm. Each element carries radio frequency current in the same phase and of magnitude 0.5 amperes. Calculate
   (i) Radiated power
   (ii) Half width of the major lobe.

4. (a) Explain the following terms:
   i. Long wire antennas
   ii. V antennas

   (b) Design a five turn helical antenna which at 300MHz operates in the axial mode and possesses circular polarization in the major lobe. Determine the following:
   (i) Near optimum circumference (in λ and in meters)
   (ii) Spacing (in λ and in meters) for near optimum pitch angle design
   (iii) Input impedance (iv) Axial ratio

Code No: R31045 **R10** **Set No: 4**

5. (a) Explain the following terms:
   i. Yagi-uda arrays
   ii. Corner reflectors
   (b) Calculate the angular aperture for a paraboloid reflector antenna for which the aperture number is
   (i) 0.25
   (ii) 0.50
   (iii) 0.60
   Given the diameter of the reflector mouth is 10m. Calculate the position of the focal point with reference to the reflector mouth in each case

6. (a) Explain the procedure for measuring the Directivity of antenna.
   (b) Calculate the minimum distance required to measure the field pattern of an antenna of diameter 2m at a frequency of 3GHz. Derive the necessary equations.

7. (a) Discuss the effects of earth's magnetic field on ionosphere radio wave propagation.
   (b) Communication by ionosphere propagation is required for a distance of 200Km. Height of the layer is 220Km and critical frequency is 5MHz. Find Maximum Usuable Frequency.

8. (a) Explain the Tropospheric wave propagation.
   (b) Determine the height of the transmitting antenna to obtain a maximum distance of transmission upto 38km from a 24 meter high receiving antenna.

*****