Code No: RR310402 **Set No. 1**

III B.Tech I Semester Regular Examinations, November 2006
ANTENNA AND WAVE PROPAGATION
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆⋆⋆⋆⋆

1. (a) Define Reciprocity theorem and prove it in case of an Antenna system.
   (b) Show that for a Hertzian dipole, the aperture area is 0.12 λ^2 and for a half-wave dipole, it is 0.13 λ^2 and for an isotropic radiator, it is 0.08 λ^2. Explain the relation used. [8+8]

2. (a) Define and account for the presence of
      i. Radial power flow
      ii. Radiation resistance for a short dipole,
      iii. Uniform current distribution
   (b) Obtain the relative amplitudes of radiation, induction and electro-static fields at a distance of 2λ from a short current element having an uniform current of 1 mA along its length. [8+8]

3. (a) Sketch the radiation pattern of a two element array with λ spacing, $\alpha = 180^0$ and fed with equal amplitudes. Derive the expression used.
   (b) What are the conditions for obtaining a Hansen-Wood yard EFA? Describe its characteristics. [8+8]

4. Write notes on:
   (a) Parasitic elements and their reference
   (b) Terminated antennas
   (c) Applications of Rhombic Antenna.
   (d) Multi director Yagi Antenna. [4+4+4+4]

5. (a) List out the frequency ranges of operation and applications of
      i. Loop antennas
      ii. Helical antennas
      iii. Lens antennas.
   (b) Derive the EMF equation for a small loop antenna. [12+4]

6. (a) Write Notes on:
      i. E-plane metal plate lens antennas,
      ii. aperture blocking in lens antennas.

(b) List out all the precautions to be taken while conducting antenna pattern measurements. [10+6]

7. (a) What is signal fading? List the various types of fading and explain.

   (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.

   [8+8]

8. A communication link is to be established between two stations using half wavelength antenna for maximum directive gain. Transmitter power is 1Kw, frequency of operation is 100 MHz and distance between transmitter and receiver is 100 Km. What is the maximum power received by receiver? Explain and derive the formulas used. [16]

⋆⋆⋆⋆⋆

Code No: RR310402 **Set No. 2**

III B.Tech I Semester Regular Examinations, November 2006
ANTENNA AND WAVE PROPAGATION
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Explain the significance of principal planes in the description of radiation pattern of antennas. Hence define and distinguish between: Horizontal and vertical plane patterns, E & H plane patterns.
   (b) For a source with radiation intensity u = 6 Cosθ, find the directivity and HPBW, when its pattern is uni directional. [8+8]

2. (a) Derive expressions for vector magnetic and scalar electric potentials. Explain the concept of retarded potentials.
   (b) A grounded vertical antenna has an effective height of 111.3 mts and operates at a wavelength of 18.8 Km with an rms value of base current of 725 Amps. Find the E & H fields at a distance of 175 Km and power radiated by it.

   [8+8]

3. (a) What is array factor? Find the array factor of two element array?
   (b) For an array of two identical infinitesimal dipoles oriented with a separation of D and phase excitation difference B between the elements, find the angles of observation where the nulls of the array occur. The magnitude of excitation of the elements is same. [8+8]

4. (a) Establish the voltage-current relations in the parasitic elements of a 3-element Yagi-Uda Array, and account for its Z_{in}.
   (b) Explain the significance of the following terms in a Rhombic Antenna.
      i. Leg length and tilt angle
      ii. Effect of earth on its pattern.
      iii. Terminating resistance and input resistance. [10+6]

5. (a) List out the different types of microwave antennas and distinguish between them.
   (b) With neat schematics, explain the constructional features and tolerances for a paraboloid. Obtain an expression for its curved profile. [6+10]

6. (a) Distinguish between sectoral, Pyramidal and Conical Horns, with neat sketches. List out their utility and applications.
   (b) With neat set up, explain the absolute method of measuring the gain of an antenna. [8+8]

7. (a) A short wave broadcasting service is to be established covering a distance of 6000 km in three hops, each 2000 km long. Assume that reflection takes place at a height of 250 km and that the electronic density is 5 $\times 10^{11} m^3$. What frequency and the angle of incidence should be used? Explain the relations used.

   (b) Explain the significance of the forms: Attenuation factors, polarization requirements and spherical earth considerations - for the propagation of 550KHz-1MHz signals. [8+8]

8. (a) Discuss the advantages and disadvantages of communication at ultra high frequencies.

   (b) How does the field strength of UHF signals depend on the heights of the transmitting and receiving antennas? Derive the relation and explain its variation with distance. [6+10]

⋆⋆⋆⋆⋆

III B.Tech I Semester Regular Examinations, November 2006
ANTENNA AND WAVE PROPAGATION
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
⋆ ⋆ ⋆ ⋆ ⋆

1. (a) Derive a relation for voltage produced by a linear antenna in terms of effective height and rms field strength, in case of sinusoidal field variations.
   (b) Show that the directivity of a short antenna is 3/2.
   (c) Calculate the electric field (Erms) due to an isotropic radiator radiating 1 KW power at a distance of 1 Km from it. [5+6+5]

2. (a) Explain the terms Poynting vector, Impedance of free space and bring out their relation with radiation fields of an antenna.
   (b) Show that the rms field strength from an antenna with gain G, radiating P watts of power is given by, $E = \frac{(30PG)^{1/2}}{r}$ Volts / mts. in free space. Find E at a distance of 1km., if the radiated power is 1kW for
      i. an isotropic case,
      ii. a half wave dipole. [8+8]

3. (a) What is array factor? Find the array factor of two element array?
   (b) For an array of two identical infinitesimal dipoles oriented with a separation of D and phase excitation difference B between the elements, find the angles of observation where the nulls of the array occur. The magnitude of excitation of the elements is same. [8+8]

4. (a) Sketch and explain the fields and patterns due to a half wave length antenna in
      i. resonant mode, and
      ii. Travelling wave mode.
   (b) Distinguish between a Uniform Linear Array and a Yagi-Uda Array. Why is a Yagi array called "super-directive" Array? [8+8]

5. (a) Draw the different shapes of small loop antennas and explain its operation by drawing the radiation pattern.
   (b) List out the conditions broadside and end fire type of modes of operations are possible helical antennas. Compare their patterns and characteristics. [6+10]

6. (a) With reference to frequency of usage and aperture blocking, describe the performances of paraboloids and lens antennas.

(b) Explain the method of measurement of HPBW of a horn antenna in H-plane, with a neat set up. [8+8]

7. (a) Account for the type of propagation and the associated characteristics for medium wave radio broadcast signals.

   (b) Define and distinguish between the terms: MUF, LUHF, Optimum frequency.

   [8+8]

8. Write explanatory notes on the following.

   (a) Tropospheric scattering

   (b) Radio horizon and optical horizon

   (c) Elevated duct, and surface duct. [6+6+4]

⋆⋆⋆⋆⋆

Code No: RR310402 **Set No. 4**

III B.Tech I Semester Regular Examinations, November 2006
ANTENNA AND WAVE PROPAGATION
(Common to Electronics & Communication Engineering and Electronics & Telematics)

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

⋆ ⋆ ⋆ ⋆ ⋆

1. (a) State and explain reciprocity theorem. Explain how this theorem can be applied to the case of a pair of parallel dipoles.
   (b) Establish the relations between directivity and effective area, directivity and effective length. [8+8]

2. (a) What are the main characteristics of a radiated wave in the far field region? The components of a wave in the far field region are $E_\theta = 3$mV/m and $E_\varphi = 4$mV/m. Calculate the total electric and magnetic fields, in free space.
   (b) For a broad cast antenna of 20 m height at 750 kHz, find the expressions of far fields E and H and radiation resistance for an input excitation of 1mA current. [8+8]

3. (a) How an unidirectional pattern is obtained in an end fire array? Explain in detail?
   (b) Draw the radiation pattern of 8 isotropic elements fed in phase, spaced $\lambda/2$ apart with the principle of pattern multiplication. [8+8]

4. (a) With neat schematics, describe the principle of working of a 3 element yagi antenna, listing out its length and spacing requirements.
   (b) Sketch the current distributions on a folded dipole, and account for its input impedance when the two legs have unequal diameters. [8+8]

5. (a) Sketch and explain the constructional features of a helical antenna. Distinguish between axial and normal modes of helix radiations and list out their requirements.
   (b) Explain the characteristics of an active square corner reflector with the help of image principle. [10+6]

6. (a) With neat schematics, establish the mathematical relations for the profiles of a Plano-convex dielectric lens. Explain its characteristics.
   (b) Explain the necessity for uniform phase requirements in antenna measurements. How is it achieved in practice? [8+8]

7. Write explanatory notes on:
   (a) Selective fading and interference fading
   (b) Optimum working frequency and LUHF.

(c) Field strength calculation for radio AM broadcast waves.

(d) Ionosheric abnormalities. [4+4+4+4]

8. (a) What is LOS propagation? Under what conditions it can exist?

   (b) Establish the relations for not received fiend strength of in LOS propagated wane at

      i. small distances, and

      ii. large distance and sketch their variations with distance. Compare base variations with corresponding free space value. [6+10]

⋆⋆⋆⋆⋆