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

III B.Tech. I Semester Regular Examinations, November -2005
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) Distinguish between the terms: effective length and effective area and deduce the relation between them.
   (b) How is the radiation pattern of an antenna specified?
   (c) Find the directivity and HPBW of an antenna having a unidirectional $\cos\theta$ radiation intensity pattern. [6+4+6]

2. Starting with the expression Idl for a current element, show that the phasor expression for vector potential and field strengths will be
   $A_z = \frac{\mu Idl}{4\pi r} e^{-j\beta r}$
   $H_\varphi = \frac{Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r}\right)$
   $E_\theta = \frac{\eta Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r} + \frac{1}{j\beta r^2}\right)$
   $E_r = \frac{\eta Idl \cos\theta e^{-j\beta r}}{4\pi r}\left(\frac{2}{r} + \frac{2}{j\beta r^2}\right)$
   $where \beta = \omega/\nu = 2\pi/\lambda, \eta = \sqrt{\mu/\in}$ [8+8]

3. (a) Derive the conditions for the linear array of N isotropic elements to radiate in end fire and broad side modes, and find the first two side lobe levels.
   (b) What is a uniform linear array and what are its applications? [10+6]

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) List out the differences between the active and passive corner reflectors. What are retro reflectors?
   (b) Sketch the far field patterns of loops of 0.1λ, λ and $3\lambda/2$ diameter. What is the effect of the shape of the small loop on its far field pattern. [8+8]

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. 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 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]

⋆ ⋆ ⋆ ⋆ ⋆

III B.Tech. I Semester Regular Examinations, November -2005
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. Starting with the expression Idl for a current element, show that the phasor expression for vector potential and field strengths will be
   $A_z = \frac{\mu Idl}{4\pi r} e^{-j\beta r}$
   $H_\varphi = \frac{Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r}\right)$
   $E_\theta = \frac{\eta Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r} + \frac{1}{j\beta r^2}\right)$
   $E_r = \frac{\eta Idl \cos\theta e^{-j\beta r}}{4\pi r}\left(\frac{2}{r} + \frac{2}{j\beta r^2}\right)$
   $where \beta = \omega/\nu = 2\pi/\lambda, \eta = \sqrt{\mu/\in}$ [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) Using the principle of pattern multiplication, obtain the resultant pattern of a long wire antenna and sketch the same.
   (b) Explain all the structural requirements of a 5-element Yagi antenna at 475 mHz, accounting for typical spacing, length to diameter ratios and Z_{in}.

   [8+8]

5. (a) With neat schematics, derive the expression for pitch angle to get circularly polarized radiation pattern for a helical antenna, operating in broadside mode, and sketch its pattern.
   (b) What are the different advantages and disadvantages of loop antennas?

   [10+6]

6. (a) With neat set up, explain the method of measurement of the beam width of a pyramidal horn antennas in E-plane. How does it differ from H-pane measurement?

(b) Given that the radiation patterns of an antenna are measured, explain how their directivity and power gain can be evaluated? [8+8]

7. Write short notes on

   (a) D - layer

   (b) Dellinger fade - out

   (c) Fading

   (d) Atmospheric noise

   (e) Sporadic-E layer [4+3+3+3+3]

8. A television transmitting antenna mounted at a height of 120 m radiates 15Kw of power equally in all directions in azimuth at a frequency of 50MHz. Calculate

   (a) Maximum line of sight range,

   (b) The field strength at a receiving antenna mounted at a height of 16 m at a distance of 12Km and

   (c) the distance at which the field strength reduces to 1 mv/m,

   (d) presence of sky waves space waves, and ground waves in this case. [4+4+4+4]

⋆ ⋆ ⋆ ⋆ ⋆

Code No: RR310402 **Set No.3**

III B.Tech. I Semester Regular Examinations, November -2005
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 the term input "impedance" of an antenna. Show that the input impedance of an antenna used in a transmitting mode is the same as the input impedance if it is used in receiving mode. Clearly mention the assumptions made in proving this relation.
   (b) Define and derive a relation for effective length 'le' of an antenna. Find 'le' or a short dipole antenna. [8+8]

2. Starting with the expression Idl for a current element, show that the phasor expression for vector potential and field strengths will be
   $A_z = \frac{\mu Idl}{4\pi r} e^{-j\beta r}$
   $H_\varphi = \frac{Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r}\right)$
   $E_\theta = \frac{\eta Idl \sin\theta e^{-j\beta r}}{4\pi r}\left(j\beta + \frac{1}{r} + \frac{1}{j\beta r^2}\right)$
   $E_r = \frac{\eta Idl \cos\theta e^{-j\beta r}}{4\pi r}\left(\frac{2}{r} + \frac{2}{j\beta r^2}\right)$
   $where \beta = \omega/\nu = 2\pi/\lambda, \eta = \sqrt{\mu/\in}$ [8+8]

3. (a) Derive the conditions for the linear array of N isotropic elements to radiate in end fire and broad side modes, and find the first two side lobe levels.
   (b) What is a uniform linear array and what are its applications? [10+6]

4. (a) Using the principle of pattern multiplication, obtain the resultant pattern of a long wire antenna and sketch the same.
   (b) Explain all the structural requirements of a 5-element Yagi antenna at 475 mHz, accounting for typical spacing, length to diameter ratios and Z_{in}.
   [8+8]

5. (a) Find the radiation resistance and directivity of a one circular loop antenna of 20cm diameter at a frequency of 100MHz. What happens-
      i. if this loop is changed into a square loop of same area and
      ii. if the number of turns of this circular loop is doubled?
   (b) A parabolic owlish provides a power gain of 75dB at 15GHz, with 65% efficiency. Find its BWFN, HPBW, diameter. [8+8]

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) Discuss the importance of ground wave propagation for communication purposes. Why ground waves are not received beyond certain range. Explain the phenomenon.

   (b) Establish the effects of D-layer in sky wave propagation. [10+6]

8. (a) Discuss the phenomenon and effect of the reflection of radio waves by earth's surface.

   (b) Explain the principle of operation of terrestrial line of sight communication. [8+8]

⋆ ⋆ ⋆ ⋆ ⋆

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

III B.Tech. I Semester Regular Examinations, November -2005
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. Derive the expressions for radiation fields from a vertical $\lambda/2$ radiator and hence prove that it has a radiation resistance of about 73 ohms. List out all the assumptions involved, and sketch its radiation patterns in both principal planes. [16]

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) Evaluate the power gain directing and the required diameter of a paraboloid having a null beam width of 10^0 at 3 GHz.
   (b) What are the requirements to design a circularly polarized efficient helical antenna? [8+8]

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) State and explain Sommerfield equation for ground wave propagation?
   (b) Describe the salient features of multi hop propagation. Account for the permissible ranges of frequencies in both these cases. [8+8]

8. (a) Establish the mathematical relations for:
   i. Ratio horizon,
   ii. radius of curvature of array path for los waves
   (b) Explain the significance of flat earth and curved earth considerations for tropospheric wave propagation. [5+5+6]

⋆ ⋆ ⋆ ⋆ ⋆