III B.Tech. I Semester Supplementary Examinations, April/May -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
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1. (a) Define and explain: Directivity and power gain for an antenna. What is the relation between the two? Prove that the directivity of a $\lambda/2$ aerial is 0.39 db more than that of a short dipole.
   (b) What are principal planes? How the antenna beam width are defined in such planes?

2. (a) Derive the expression for electric field in case of short current element and hence obtain conditions for the field to be in Fraunhofer region.
   (b) Give the expression for electric field due to a current element. Find the distance from a radiating element with 60 Hz current such that radiation and induction fields are equal.

3. (a) Obtain the expression for the beam width of broadside and end fire arrays and compare them?
   (b) Explain the principle of multiplication of patterns.

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.

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.

6. (a) With neat schematics, explain the method of measurement of the gain of a horn antenna by 3 antenna technique.
   (b) Explain the basic principles of operation of lens antennas. Hence distinguish between the different types of lens antennas, explaining their curvature profiles.

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.

8. (a) Show that the radios of curature of the ray path is given by $-\frac{2}{\left(\frac{d\in_r}{dh}\right)}$ for tropospheric waves.

(b) Distinguish between the froms standard atmosphere, substandard propagation, and super standard conditions.

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

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

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) From the knowledge of Directive gain 'g_d', Prove the following relation.
$g_d = \frac{120\pi^2}{R_{rad}} \left(\frac{l_e}{\lambda}\right)^2$ Where l_e = effective length of the antenna
R_{rad} = Radiation resistance of the antenna.
and state the importance of this relation.
   (b) A source has bidirectional power pattern with a radiation intensity of U = 4 sin θ. Find its directivity and HPBW, sketching the pattern.

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.

3. (a) Compare the radiation characteristics of Uniform Linear Arrays, fed with-
      i. Uniform amplitudes
      ii. Triangular taper amplitudes
      iii. Binomially tapered amplitudes.
   (b) list out the mathematical relations for a N element half-wavelength spaced binomial array. Hence, find the directivity, HPBW for N=20 case. What is the expression for its field pattern?

4. (a) Explain how a Yagi-Uda antenna is analyzed as an EFA, listing and the necessary mathematical relations. Why is it called a Super Gain Antenna?
   (b) Describe the characteristics of long wire traveling wave antennas, sketching their patterns for different lengths.

5. (a) Establish and explain the gain and beam width relations for a parabolic reflector and account for its beam shaping considerations.
   (b) Write short notes on: Cassegrainian antennas.

6. (a) Explain the first transmission formula and its applicability for antenna gain measurements.
   (b) Explain the significance, merits and demerits of zoning in lens antennas.

7. (a) Describe in detail the characteristics, frequency range and distance of coverage for each mode of radio wave propagation.
   (b) Write short notes on fading of short wave broadcast signals.

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.

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

III B.Tech. I Semester Supplementary Examinations, April/May -2005
ANTENNA AND WAVE PROPAGATION
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Define and explain the significance of the terms: Radiation intensity, Beam area, Beam efficiency, effective height, and resolution.
   (b) A source has a constant power pattern limited to top half of the hemisphere only. Find its directivity and effective area.

2. (a) From the expressions for E & H due to a radiating element, show the average power radiated is given by,

$$\mathrm{p_{av}} = \frac{\mathrm{E}^2_{\mathrm{max}}}{2\eta}\,\mathrm{w/mt}^2$$

   Where η is the intrinsic impedance of the medium.
   (b) Obtain the power radiated by a ($\lambda/10$) dipole in free space if the current distribution is
      i. uniform and
      ii. triangular,

   and is given by I peak =2.0 Amps. What will be radiation resistance?

3. (a) Find the radiation pattern of linear array of three isotropic sources spaced $\lambda/2$ apart and sketch it. The excitations of sources are in phase and have amplitude ratio 1:2:1.
   (b) Find the radiation pattern of four isotropic elements fed in phase, spaced $\lambda/2$ apart by using pattern multiplication.

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}.

5. (a) Establish and explain the gain and beam width relations for a parabolic reflector and account for its beam shaping considerations.
   (b) Write short notes on: Cassegrainian antennas.

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.

7. (a) What are the factors that lead to fading and attenuation in ionospheric propagation.
   (b) What is the wave tilt and how does it effect the field strength received at a distance from the transmitter?
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.

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

III B.Tech. I Semester Supplementary Examinations, April/May -2005
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks

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1. (a) Define and explain "effective length" for an antenna. With the help of reciprocity theorem (or otherwise) establish the equality of transmitting and receiving effective lengths of transmitting and receiving antennas.
   (b) Define gain, power gain, directive gain and directivity of an antenna. Prove that the directivity of a $\lambda/2$ dipole is 2.15 dB.
2. (a) Starting from the complete expressions for electric field and magnetic field due to a small current element, distinguish between Induction and radiation fields. Hence define the boundary between far field and near fields of the antenna.
   (b) Obtain the simplified relations for electric and magnetic fields in far field and hence find the value of medium impedance and the radiated power.
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.
4. (a) Compare the requirements and radiation characteristics of resonant and non-resonant radiators?
   (b) Determine the lengths and spacing requirements for a 3-element Yagi -Uda antenna array at 500 mHz, and explain its characteristics.
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.
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.
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.

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.

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