Code No: R05310403 **Set No. 1**

III B.Tech I Semester Supplimentary Examinations, February 2008
ANTENNAS 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) Explain the following terms:
   i. Beam Width
   ii. Omni Directional pattern
   iii. Side Lobe Level
   iv. Radiation resistance
   v. Field Pattern of antenna.
   (b) Define the terms Directivity and Power Gain. Show that the Directivity of a short current element is 1.5. [8+8]
2. (a) Starting from the fundamentals, derive an expression for radiated electric field for half wave dipole and sketch the field strength pattern.
   (b) Prove that l_{eff}(transmitting) is same as l_{eff}(receiving) for any antenna where l_{eff} is effective length of an antenna. [8+8]
3. (a) How an unidirectional pattern is obtained in an end fire array? Explain in detail.
   (b) List out the mathematical relations for a N element half wavelength spaced binomial array. Hence find the directivity, HPBW for N=20. [8+8]
4. (a) Explain how a rhombic Antenna is formed by a V antenna and an inverted V Antenna.
   (b) Explain the reason why length of a traveling wave radiation is multiple of half wave length. [8+8]
5. (a) Discuss the application of the Image antenna concept to the 90^0 corner reflector.
   (b) What is a parabolic cylinder antenna? Derive an expression for field distributions on the surface of reflector. [8+8]
6. (a) What is Zoning? What are its advantages?
   (b) Discuss the applications of Horn Antenna. Sketch the sectoral horns. [8+8]
7. (a) Show that Ionosphere act as a variable refractive index medium.
   (b) A radio link has to be established between two earth station at a distance of 25000kms. If the height of ionosphere is 200kms and its critical frequency is 5MHz. Calculate the MUF for the given path. Also calculate the electron density in the ionosphere layer. [8+8]

8. (a) A police radio transmitter operating at a frequency 1.69GHz is required to provide a ground wave having a strength of 0.5mv/m at a distance of 16km. The transmitter antenna, having an efficiency of 50% produces a radiating field proportional of cosθ. The ground wave has $\sigma = 5 \times 10^{-5}$ mho/cm and $\varepsilon_r = 15$. Calculate the power transmitted.

   (b) Derive the fundamental equation for free space propagation. [8+8]

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Code No: R05310403 **Set No. 2**

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ANTENNAS AND WAVE PROPAGATION
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. Find the effective length of a $\lambda/2$ dipole and $\lambda/4$ monopole. Hence calculate their directivities, using the appropriate radiation resistances. [16]

2. (a) Derive expressions for the electric and magnetic fields radiated by a half wave length dipole antenna.
   (b) A grounded vertical antenna has an effective height of 111.3 mts and operates at a wavelength of 18.8kms,with base current of 725 amps, Find the E and H fields at a distance of 150kms and power radiated by it. [8+8]

3. (a) What is the necessity of an Array? Explain the three different types of arrays with regard to beam pointing direction.
   (b) 64 isotropic elements are to be arranged in a binomial array form. Determine the current ratios and find polar plot of the array. [8+8]

4. (a) Describe the construction and properties of Rhombic Antenna.
   (b) Describe the characteristics of long wire traveling wave antenna. Sketch their pattern for lengths of
      i. $\lambda/2$
      ii. 5 λ
      iii. 20 λ. [10+6]

5. (a) With reference to paraboloids,explain the following:
      i. Aperture Efficiency
      ii. Front toBack Ratio
      iii. Types of Feeds.
   (b) Design Yagi-Uda antenna of six elements to provide a gain of 12dB if the operating frequency is 200MHz. [8+8]

6. (a) What is the principle of equality of path length? How is it applicable to horn antenna?
   (b) Discuss how the directivity of horn antenna can be measured. [8+8]

7. (a) Show that Ionosphere act as a variable refractive index medium.
   (b) A radio link has to be established between two earth station at a distance of 25000kms. If the height of ionosphere is 200kms and its critical frequency is 5MHz. Calculate the MUF for the given path. Also calculate the electron density in the ionosphere layer. [8+8]

8. (a) Prove that the radio horizon distance between transmitting and receiving antennas is given by dmiles=$\sqrt{2}h_t+\sqrt{2}h_r$.
   (b) Write short notes on "Troposcatter". [8+8]

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Code No: R05310403 **Set No. 3**

III B.Tech I Semester Supplimentary Examinations, February 2008
ANTENNAS AND WAVE PROPAGATION
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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) As related to Antennas, define and explain the following terms:
   i. Directivity
   ii. Radiation Resistance
   iii. Beam Width
   iv. Band Width.
   (b) Evaluate the directivity of
   i. An Isotropic Source
   ii. Source with Bi-Directional cos θ power pattern. [8+8]

2. (a) What is Retarded Potential? Explain different approaches to solve radiation Problems.
   (b) Explain the Lorentz Gauge Condition and show that
   $\nabla\ \nabla.\ \bar{A}/j\omega\mu\varepsilon\text{-}j\omega\ \bar{A} = 1\ /\ j\omega\mu\varepsilon\ (\nabla*\nabla*\bar{A})$
   where $\bar{A}$ is magnetic vector potential. [8+8]

3. (a) Explain the principle of pattern multiplication.What is the effect of earth on the radiation pattern of antennas.
   (b) A uniform linear array consists of 16 isotropic point source with a spacing of $\lambda/4$ if the phase difference α=-90^0. Find
   i. HPBW.
   ii. Directivity.
   iii. Effective aperture. [8+8]

4. (a) Explain the construction and radiation characteristics of Helical Antenna.
   (b) What is a 'V' antenna. Explain its characteristics. [8+8]

5. (a) Explain how the radiation pattern of folded dipole will be modified with the addition of a reflector and two directors parasitic elements.
   (b) Bring out the differences between Active and Passive Corner Reflectors. What are Retro Reflectors? [8+8]

6. (a) Explain the principle of operation of Dielectric Lens Antenna.
   (b) Write short notes on "Radiation from Sectoral Horn". [8+8]

7. (a) What are different mechanisms of propagation of electromagnetic waves? Explain.
   (b) What is Critical Frequency? What is Virtual Height? Find the maximum distance that can be covered if the virtual height of the ionospheric layer is 250kms. [8+8]

8. (a) Write short notes on "M Curves and their characteristics".
   (b) Show that the radius of curvature of ray path is given by $2/(d\varepsilon_r/dh)$ for tropospheric waves. [8+8]

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Code No: R05310403 **Set No. 4**

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

Answer any FIVE Questions
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1. (a) Explain the terms "Isotropic", "Directional" and "Omni directional pattern", "Radiation Intensity".
   (b) Define Effective Aperture and calculate the effective aperture of a 0.25 λ dipole. [8+8]
2. (a) State the Reciprocity Theorem for Antennas? Prove that the Self Impedance of an Antenna in transmitting and receiving mode is same.
   (b) Define Directivity. Obtain the Directivity of an Isotropic Antenna, Short Dipole and Half-Wave Dipole. [8+8]
3. (a) What are the various differences between binomial and linear arrays.
   (b) Design a 8 element broadside array of isotropic sources of $\lambda/2$ spacing between elements. The pattern is to be optimum with a side lobe level 26db down the mainlobe maximum. [8+8]
4. (a) Distinguish between
      i. Resonant and Non Resonant antennas.
      ii. Narrow Band and Wide Band antennas.
   (b) Show that a single wire excited with a traveling wave current is an end fire antenna with a sharp null along the direction of extension of the wire. [8+8]
5. (a) A Paraboloid reflector of 1.8m diameter is used at 6GHz. Calculate the beam width between the nulls and gains in dBs.
   (b) Design Yagi Uda antenna of six elements to provide a again of 12dB if the operating frequency is 200MHz. [8+8]
6. (a) Distinguish between Sectoral, Pyramidal and Conical horns. Explain their utility.
   (b) With a neat setup, explain the absolute method of measuring the gain of an antenna. [8+8]
7. (a) Describe the salient features of Ground wave propagation. Discuss the effect of frequency earth constants and curvature of earth on ground wave propagation.
   (b) Communication by ionosphere propagation is required for a distance of 200kms. height of the layer is 220kms and the critical frequency is 5MHz. Find MUF. [8+8]

8. (a) Write explanatory notes on
   i. Selective fading and Interference fading.
   ii. Field Strength calculation for radio AM broadcast waves.
   (b) A communication link is to be established between two stations using half length antenna for maximum distance gain. Transmitter power is 1KW, distance between transmitter and receiver is 100km. What is the maximum power received by receiver? Frequency of operation is 100MHz. [8+8]

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