

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**B. Tech III Year I Semester Examinations, November/December - 2012****ANTENNAS AND WAVE PROPAGATION****(Common to ECE, ETM)****Time: 3 hours****Max. M****Answer any five questions
All questions carry equal marks**

- 1.a) Define the following terms as applicable to antennas, and state their significance:
 - i) Beamwidths and Beam Area,
 - ii) Radiation Intensity and Radiation Resistance.
- b) For an antenna radiating into the upper hemisphere with a far field pattern of $2 \cos \theta$, estimate the HPBW, BWFN, directivity and beam efficiency. [9+6]
- 2.a) With neat schematics, explain the configuration of an oscillating electric dipole and derive its far field expressions.
- b) For a 20 m. vertical dipole antenna, find the power radiated, radiation resistance and radiation efficiency at 1 MHz, with an input peak current of 500 mA and a loss resistance of 2.5 ohms. [9+6]
- 3.a) Using the Principle of Pattern Multiplication, estimate and sketch the pattern of a 8 element Binomial array by computing its amplitude coefficients.
- b) Derive the Array Factor of a 4-element Endfire Array with $\lambda/2$ spacing and equal excitation amplitudes. Compute its nulls, sidelobe levels, BWFN, and sketch the pattern. [6+9]
- 4.a) Distinguish between the axial and normal modes of radiation characteristics of a helical antenna, and identify their requirements.
- b) State the Fermat's Principle, and explain its applicability to Horn Antennas. What is an Optimum Horn? List out the standard horn antennas and give their applications. [8+7]
- 5.a) Give the expressions for impedance, bandwidth and directivity of rectangular patch antenna.
- b) Design a rectangular microstrip antenna using a substrate with a dielectric constant of 2.2, height $h = 0.1588$ cm so as to resonate at 10 GHz. [8+7]
- 6.a) With a neat block diagram, explain the measurement method of the Gain of a horn antenna by absolute method.
- b) Distinguish between different types of lens antennas, and estimate the curvature profile of a dielectric delay lens. [7+8]
- 7.a) Define and distinguish between the terms - (i) Critical Frequency and MUF, (ii) LUF and Optimum Frequency, (iii) Virtual height and skip distance.
- b) Explain the significance of E and F layers of ionosphere, and account for the multi-hop propagation of sky waves. [7+8]

8.a) Sketch and explain the field strength variation of space waves, with distance and antenna heights, deriving expressions for the same.

b) Find the MUF and refractive index for a sky wave signal, reflected by a layer at a height of 200 km, and having an electron density of 2.0×10^{11} per cubic meter, for a skip distance of 2500 km. Also calculate the corresponding angle of incidence. Explain the relations used. [7+8]

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