Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
NOV/DEC 2015
SUBJECT: ANTENNAS (ECE 307)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ANY FIVE** full questions.
- Missing data may be suitably assumed.

1A. Design a broadside Dolph-Tschebyscheff array of 6 elements with spacing "d" between the elements and with major-to-minor lobe ratio of 20 dB. Find the excitation coefficients, nulls at $d = \lambda/4$ and form the array factor.

1B. Derive an expression for the maximum effective aperture of an antenna in terms of its maximum directivity.

1C. Write explanatory note on Yagi-uda Antenna

(5+3+2)

2A. The normalized radiation intensity of a given antenna is given by, $U = \sin(\theta)\, sin^2(\emptyset)$. The intensity exists only in the $0 \leq \theta \leq \pi$ *and* $0 \leq \emptyset \leq \pi$ *region and zero elsewere.* Find the directivity using all formulas.

2B. State and prove reciprocity theorem for far field.

2C. Explain with neat diagram, working principle of microstrip antenna.

(5+3+2)

3A. Find the radiation efficiency of a single-turn and 8 turn small circular loop at f = 100MHz. The radius of the loop is λ/25, radius of the wire is 10^{-4} λ, and turns are spaced $4\text{x}10^{-4}$ λ apart. Assume the wire is copper with a conductivity of $5.7\text{x}10^{7}$ (s/m) and the antenna is radiating into free space. Let $R_p/R_o = 0.38$

3B. An infinitesimal Dipole of length $l = \lambda/50$ of constant current I_0 placed vertically above the ground plane at the height of $h = 2\lambda$, find all the nulls that occurs.

3C. Write explanatory note on Huygen's & Babinet's Principle

(5+3+2)

4A. Starting from fundamental derives an expression for FNBW, HPBW and FSLBW(First side lobe beam width) for an N element, broadside array of isotropic point sources with uniform amplitude and spacing.

4B. Write an explanatory note on BALUNS

4C. Explain the antenna temperature with mathematical equations.

(5+3+2)

5A. Derive an expression for far zone **E** and **H** fields of a half wavelength dipole antenna. Also derive for maximum directivity and radiation resistance.

5B. A λ/2 dipole, with a total loss resistance of 1 Ω, is connected to a generator whose internal impedance is 45 + j20 Ω. Assuming the peak voltage of the generator is 5 V and the impedance of the dipole, excluding the loss resistance, is 60 + j25 Ω. Find the power (a) radiated by the antenna (b) dissipated in the antenna (c) dissipated by the generator internal resistance.

5C. Write the dual of the following equations

(i) $\mathbf{H}_A = \frac{1}{\mu}\nabla \times \mathbf{A}$ (ii) $\nabla \times \mathbf{H}_A = \mathbf{J} + j\omega\epsilon\mathbf{E}_A$

(5+3+2)

6A. Derive an expression for vector potential wave equation for an electric current source and obtain the solution for the same

6B. What is a ferrite loop and why it is used? Explain with mathematical expression.

6C. Define a) Directivity b) Radiation Intensity.

(5+3+2)