Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FOURTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
MAY/JUNE 2016
SUBJECT: ANTENNAS (ECE - 2201)

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

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Derive an expression for vector potential wave equation for an electric current source and obtain the solution for the same.

1B. Write short note on Space wave, Troposphere and Ionosphere propagation.

1C. i) If Ex = 3V/m Ey= 2V/m and $\Delta\phi = 0^o$, Then the polarization of the wave is -----

ii) The relation between the maximum effective area of a lossless antenna and its maximum directivity is given by ------

(5+3+2)

2A. Derive an expression for far zone **E** and **H** fields of a half wavelength dipole also find maximum directivity and radiation resistance.

2B. 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.

2C. Write the dual of the following equations

(i) $\boldsymbol{E_A} = -j\omega\boldsymbol{A} - j\frac{1}{\omega\mu\epsilon}\nabla(\nabla.\boldsymbol{A})$ (ii) ∇ x $\boldsymbol{E_A} = -j\omega\mu\boldsymbol{H_A}$

(5+3+2)

3A. Derive the expression for **E** and **H** due a small circular loop placed symmetrically about origin.

3B. Design a broadside Dolph-Tschebyscheff array of 5 elements with spacing "d" between the elements and with major-to-minor lobe ratio of 20 dB. Find the excitation coefficients,

3C. (i) State True/False: For a small circular loop antenna the maximum effective aperture area is less than the physical area of the loop.

(ii) Radiation resistance of small dipole of length λ/20 = --------

(5+3+2)

4A. The normalized radiation intensity of a given antenna is given by, $U = sin^2(\theta)sin^3(\emptyset)$. The intensity exists only in the $0 \leq \theta \leq \pi$ and $0 \leq \emptyset \leq \pi$ region and zero elsewhere.
a) Find the exact directivity.
b) HPBW in azimuthal and elevation planes.

4B. A vertical infinitesimal linear dipole is placed at a distance h=3λ/2 above an infinite perfectly conducting flat ground plane. Determine the angles (in degrees from vertical) where the maximum of the total field will occur.

4C. (i) For a horizontal electric dipole placed near a perfect electric conductor, at h=2λ, the total number of lobes in its radiation pattern is ----------

(ii) For a broadside array, the direction of maximum radiation is --------.

(5+3+2)

5A. Derive an expression for the normalized Array Factor for N-element linear array with uniform amplitude and spacing having centre element as reference point. Also write expressions corresponding to the nulls and maximum values of the array factor.

5B. Write an explanatory note on BALUNS

5C. Find the radiation resistance of a single turn and 8 turns small circular loop of radius 0.2λ operating at 150MHz with a ferrite core having relative effective permeability of 640.

(5+3+2)