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. The power radiated by a lossless antenna is 10 Watts. The directional characteristics of the antenna are represented by the radiation intensity of

$U = B_0 Cos^3\theta$ (W/unit solid angle) $0 \le \theta \le \pi/2$, $0 \le \emptyset \le 2\pi$

Find the
(i). Value of B_0.
(ii). Maximum power density at a distance of 1km
(iii). HPBW (in degrees and radians)
(iv). Directivity of the antenna (dimensionless and in dB)
(v). Gain of the antenna (dimensionless and in dB)

1B. The effective antenna temperature of an antenna looking toward zenith is approximately 5°K. Assuming that the temperature of the transmission line (waveguide) is 295.2°K, find the effective temperature at the receiver terminals when the attenuation of the transmission line is 0.0015 Np/mtr and its length is 0.5 meter.

1C. (i). The far field region for a resonant half wave dipole antenna at 550MHz is ≥ _____meters
(ii). The solid angle of area bounded by a spherical surface $20^0 \le \theta \le 40^0$ and $30^0 \le \emptyset \le 70^0$ is_____

(5+3+2)

2A. Derive an expression for the vector potential ***F*** for a magnetic current source ***M*** and also derive solution for the vector wave equation.

2B. Define the following terms
i) Isotropic, Omni directional radiation patterns
ii) Radian, Steradian
iii) Half power beam width (HPBW), First null beam width(FNBW)

2C. (i). If E_x=2 V/m E_y= 1V/m and $\Delta\phi$ = 90°, then the polarization of the wave is _____
(ii). The Friss transmission equation that relates the power received to the power transmitted between two antennas is _____

(5+3+2)

3A. A small dipole of length $\lambda/50 \le l \le \lambda/10$ is placed symmetrically about the origin and directed along the z-axis. Derive the Far-zone fields radiated by the dipole, radiated power, directivity and radiation resistance of the antenna.

3B. Assume '*h*' is smallest height that an antenna must be placed above a perfect electric ground plane so that its pattern has only one null (aside from the null toward vertical), and it occurs at 30° from the vertical. Determine '*h*' and number of lobes for that '*h*' if antenna is

(i) Infinitesimal vertical electric dipole of length $\lambda/50$.

(ii) Infinitesimal horizontal electric dipole of length $\lambda/50$.

3C. (i).The way to increase the radiation resistance without increasing the electrical dimensions of a loop antenna is _____

(ii). During analytical formulations for the patterns of vertical and horizontal diploes, it is a common practice to assume that the earth is flat. Define Divergence factor, which uses to resolve this assumption.

(5+3+2)

4A. A small circular loop with constant current I_0 positioned symmetrically on the x-y plane, at z=0. Derive the far zone fields radiated by the loop, radiated power and radiation resistance.

4B. Derive an expression for the maximum directivity of N-element broadside linear array, staring from the normalised AF.

4C. (i).The mode of EM wave propagation that suits from 30MHz to 300MHz is _____

(ii). Name the mode of radio wave propagation in which electromagnetic waves reach the receiving point after reflection from the ionized region in the upper atmosphere.

(5+3+2)

5A. Design a six element -20 dB Dolph -Tschebyscheff array of isotropic elements placed symmetrically about the z-axis. Find the amplitude excitation coefficients and the array factor. If $d = 3\lambda/4$ calculate the nulls.

5B. Explain all types of matching techniques used to couple-match the characteristics of antenna element with transmission line.

5C. (i). When the pitch angle $\alpha = 0°$, the helix antenna reduces to _____ antenna.

(ii). In _____mode of operation of helical antenna, there is only one major lobe and its maximum radiation intensity is along the axis of the helix.

(5+3+2)