Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

FOURTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - APRIL / MAY 2017
SUBJECT: ANTENNAS (ECE - 2201)

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

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

1A. Starting from first principles, derive an expression for the radiation resistance of a small circular loop Antenna of smaller radius ($a < \lambda/10$).

1B. 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 elsewere*. Find the exact directivity.

1C. Explain the working of Yagi-Uda Antenna.

(5+3+2)

2A. Design a five element -20dB side lobe level Dolph-Tschebyscheff array of isotropic elements placed symmetrically about the z-axis. Also find the angles of nulls at $d = 3\lambda/4$

2B. Show that the input impedance of a folded dipole is four times that of an half-wave dipole under resonance condition

2C. Plot the current distribution on a linear dipole of length $\lambda/2 < l < \lambda$ for different time instants in the range $0 \leq t \leq T/2$, where T is the period.

(5+3+2)

3A. Find the smallest height that an infinitesimal dipole of length $\lambda/50$ must be placed from infinite conductor if vertically placed antenna has its pattern with nulls at 30^o. Also find its directivity and radiation resistance.

3B. Derive an expression for the Vector potential **F** for a source **M.**

3C. Find the radiation resistance of a small circular loop having 3 turns with radius = λ / 25.

(5+3+2)

4A. The E-field pattern of an Antenna has unity value in the range $0 \leq \theta \leq \pi/4$, 0.5 in the range $\pi/2 \leq \theta \leq \pi$ and zero elsewhere. (i) Find directivity. (ii) Find radiation resistance at 200m from Antenna if field is 10V/m for $\theta = 0$ and terminal current is 5A.

4B. With the help of neat sketches, write explanatory note on matching techniques.

4C. Write the dual of following relations

a) $E_A = -jwA - \frac{j}{w\mu\varepsilon}\nabla(\nabla.A)$ b) $H_A = \frac{1}{\mu}\nabla \mathrm{x} A$

(5+3+2)

5A. Derive an expression for array factor of N-Element linear array with uniform amplitude and spacing. Show that first minor lobe is 13.46dB down the maximum at the major lobe.

5B. Write an expression for **E** and **H** fields for far zone for an infinitesimal dipole placed symmetrically along Z – axis. Hence also write the same if dipole is placed symmetrically in x-y plane at 45^o.

5C. The E-field of a linearly polarized EM wave is given by $E_i = a_x E_o(x,y)e^{-jkz}$ is incident upon a linearly polarized antenna whose E-field polarization is expressed as $E_a = (a_x + a_y)E(r,\theta,\phi)$. Calculate PLF in dB

(5+3+2)