Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

FOURTH SEMESTER B.Tech. (E & C) DEGREE END SEMESTER EXAMINATION
APRIL 2018
SUBJECT: ANTENNAS (ECE - 2201)

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

Instructions to candidates

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

1A. Derive the expression for the wave equation for electric current source and find its solution.

1B. 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.

(5+5)

2A. Starting from fundamentals derive an expression for the **E** and **H** field for a small dipole.

2B. For an X-band (8.2–12.4 GHz) antenna, with aperture dimensions of 5.5 cm and 7.4 cm, find its maximum effective aperture (in cm^2) when its gain (over isotropic) is 14.8 dB at 8.2 GHz. Also find its aperture efficiency.

2C. List the matching technique for an antenna and explain anyone with neat diagram.

(5+3+2)

3A. The normalized radiation intensity of a given antenna is given by

$U = \sin^2\theta \sin^2\phi \quad , 0 \le \theta \le \pi, 0 \le \varphi \le \pi$.

Find the directivities by using all the methods

3B. Explain the construction & working of Yagi Uda antenna with neat diagrams. Also draw its radiation pattern.

3C. State the Lorentz Reciprocity theorem in both differential and integral form.

(5+3+2)

4A. Design a 4 element binomial array of isotropic elements placed along the z-axis at distance 'd= 3λ/4' apart and find its nulls and maxima. Also find beam width and directivity of array factor at d = λ/2.

4B. The Power radiated by a lossless antenna is 10W. Find $B_\circ$ and beam solid angle (Use all methods) if radiation intensity in upper hemisphere is $B_\circ \cos^3\theta$.

4C. 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)

5A. Find the radiation efficiency of a single-turn and 8 turn small circular loop at f=100MHz. the radius of the loop is $\lambda/25$, radius of the wire is $10^{-4}\lambda$, and turns are spaced $4x10^{-4}\lambda$ apart. Assume the wire is copper with a conductivity of $5.7x10^{7}$ (s/m) and the antenna is radiating into free space. Let $R_p/R_o = 0.38$

5B. Explain the working of Micro-strip Antenna with neat diagrams.

5C. Explain the term polarization and differentiate between circular and elliptical polarization.

(5+3+2)