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MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

**FIFTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION - NOV/DEC 2016**
**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. Derive an expression for vector potential wave equation for an electric current source and obtain the solution for the same.
1B. Give the current distribution plot for a linear dipole with $l=3\lambda/2$ at different instants of time. Clearly indicate the polarity of current on the dipole.
1C. Explain the working of Micro-strip Antenna with neat diagrams.

(5+3+2)

2A. Derive an expression for far zone **E** and **H** fields of a half wavelength dipole. Also determine maximum directivity and radiation resistance.
2B. Explain the radiation mechanism in a two wire transmission line system.
2C. Define a)Directivity b)Radiation Intensity

(5+3+2)

3A. Starting from fundamentals, derive an expression for FNBW, HPBW and FSLBW for an N element, broadside array of isotropic point sources with uniform amplitude and spacing.
3B. A λ/2 dipole, placed at the origin radiates an average power of 600W at frequency of 300MHz. An infinitesimal dipole placed in free space with its centre at a point P(200m,$90^0$, $70^0$) is used as receiving antenna. Assuming a lossless case,
   a) Calculate the available power at terminals of receiving antenna.
   b) What will be the received power if receiving antenna is placed at P(200m, $0^0$, $70^0$)?
3C. Determine 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)

4A. Calculate 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 $10^{-4}\lambda$, and turns are spaced $4\times10^{-4}\lambda$ apart. Assume the wire is copper with a conductivity of $5.7\times10^7$(s/m) and the antenna is radiating into free space. Let $R_p/R_o = 0.38$
4B. 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. Determine the excitation coefficients, nulls at $d = \lambda/2$ and form the array factor.
4C. Calculate the radiation resistance of a dipole whose overall length is $l = \lambda/100$.

(5+3+2)

5A. 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.* Calculate the directivity using all methods.

5B. 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.

5C. If an antenna has a field pattern of $U = sin^2(3\theta)$, calculate the HPBW and FNBW.

(5+3+2)

6A. Derive the expression for the vector wave equation due to a magnetic current source. Also write the expression for the magnetic field H due an electric current source using duality theorem.

6B. A Binomial array of 6 isotropic elements has spacing $d = \lambda/2$. Calculate (a) HPBW (b) Directivity (c) Coefficients of the Pascal Triangle

6C. Explain the working principle of Yagi-Uda antenna.

(5+3+2)