Roll No.										

Paper Code: EC-504

B. TECH.
FIFTH SEMESTER EXAMINATION, 2016-2017
ANTENNA & WAVE PROPAGATION

[Time: 2 Hours] [Total Marks: 50]

Note: Attempt *ALL* questions. Assume suitable data, if required. All question carry equal marks.

1. Attempt any TWO of the following:- **(5x2=10)**

(a) Define and derive Beam solid angle and Directivity of an Antenna. A Hertzian dipole of length dl = 0.5 m is radiating into free space. If the dipole current is 4 A and the frequency is 10 MHz, calculate the highest power density at a distance of 2 Km from the antenna.

(b) Calculate the directivity of an Hertzian dipole. Define Input and Pattern bandwidth of an Antenna. For a Hertzian dipole with radiation efficiency less than 1,show that the gain and the effective aperture are related by

$$G/A_e = 4\pi/\lambda^2$$

(c) How antenna radiates electromagnetic waves? Discuss the concept of Effective height and Antenna Temperature.

2. Attempt any TWO of the following:- **(5x2=10)**

(a) Discuss the significance of retarded potentials. How Electric potential and Magnetic vector Potentials are modified in time varying conditions? Derive them.

(b) Derive far field due to an Alternating Current Element. Calculate the radiation resistance of $\lambda/8$ Mono pole Antenna.

(c) If an element of 1 cm length radiates 1W at 3 GHz, estimate the effective current carried by the element. Define Point source. State Power theorem and its two applications.

3. Attempt any TWO of the following:- **(5x2=10)**

(a) A source has a sine squared radiation intensity power pattern.

$$U=U_m\sin^2\theta$$

Calculate its Directivity. Derive and Draw the radiation pattern of two isotropic point separated by half wave length and 90^0 phase quadrature.

(b) What is broad side array? Consider four half wave dipole linear antenna arranged in broadside array arrangement, separated by $\lambda/2$ apart. Draw its electric field radiation pattern.

(c) Derive the far field component of thin linear antenna with sinusoidal current distribution. A 6 cm longz-directed dipole carries a current of 1 A at 2.4 GHz. Calculate the electric and magnetic field strengths at a distance of 50 cm along $\theta=60^0$.

4. Attempt any TWO of the following:- **(5x2=10)**

(a) A single turn small rectangular loop symmetrically placed about the origin on the xy plane carrying retarded current [I].Calculate its far field components. Derive the Radiation resistance of small loop antenna too and define its condition also.

(b) Discuss the design of Yagi Uda antenna of five elements used in 61-68 MHz range. Discuss brief about slot Antenna.

(c) Discuss brief about Babinet's principle and Complementary Antennas. Design Rectangular Horn Antenna and write down its characteristic Parameters..

5. Attempt any TWO of the following:- **(5x2=10)**

(a) Discuss transmission and Radiation mode of helical structure. Discuss the salient features of Axial Mode Helix. Design a helical antenna operating in the axial mode that gives a directivity of 14 dB at 2.4 GHz. For this helical antenna, calculate the input impedance, half power beam width, beam width between the nulls, and the axial Ratio.

(b) Discuss tropospheric propagation and explain standard atmosphere. A line of sight 12 GHz microwave link is to be established on the surface of the earth (mean radius 6370 km).The straight line distance between the two antennas is 60 km and the height of transmitting antenna is 60 m. Calculate the minimum height of the receive antenna assuming that the propagation is taking place in the absence of atmosphere.

(c) Discuss the structure of an Ionosphere. What are the impact electromagnetic waves on Ionospheric structure? Derive the expression of complex dielectric constant of the ionized air.