B.E. (ETC) Part-Ill 6th Semester Examination, 2010

Antenna Engineering

(ET-605)

Time r 3 hours Full Marks : 70

Answer any FIVE questions.
The questions are of equal value.

1. What is a short dipole? Explain the concept of retarded potential and retarded current. Find an expression for electric field at a far distant point considering time harmonic current through the short dipole. Draw the electric field pattern in a vertical plane and mention the 3dB beamdwidth.

2. What is meant by a half wavelength antenna? Describe the method for determining the electric field at a distant point due to a half dipole. What is the value of half power beam width? Write down the value of radiation resistance for a half wave dipole. A transmitting antenna with effective height of 10 meter has a 50 A (rms) current at the base. The frequency of operation is 600 kHz. Calculate the power radiated.

3. Define the following terms in connection with the antenna performance.
   (i) Directive gain directivity; (ii) Power gain and efficiency of an antenna;
   (iii) Radiation resistance.
   An antenna is connected to a preamplifier which has a noise figure of 2 dB over an effective bandwidth of 20 MHz. What will be the effective input noise temperature of the preamplifier if the antenna noise temperature is 25 K? Also find out the available noise power output of the preamplifier.

4. A voltage source of amplitude **V** = (50+J40) **V** and a source impedance Zg = 50 **n** is connected to an antenna having a radiation resistance R_{rad} j = 70 Q, loss resistance ^loss " ¹ ft ᵃⁿᶜ* reactance jX = j25fi. Calculate the radiation efficiency of the antenna, the power delivered to the input of an antenna and power dissipated in the antenna. Draw the lumped equivalent circuit of a thin antenna.

5. What is known as antenna array? What is the usefulness of an antenna array? Distinguish between broadside and end fire antenna array. Draw the field pattern

for broad side and end fire array for a combination of four isotropic point source equidistant from each other by X/2 and fed by current of equal amplitude and equal phase. Explain pattern multiplication and illustrate it using an antenna array of eight isotropic point sources separated from each other by a distance ***X/2.***

6. Explain transmission loss between a transmitting and a receiving antenna. What is meant by actual transmission loss? An antenna with a gain of 12dB and an effective aperture of 3 m^2 is used to receive electromagnetic energy propagating in free space. If the received power is 0.1 nW, what is the power density of the wave at the antenna? If this antenna is replaced by mother antenna having a gain of 20 dB, calculate the received power in watts.

7 For an antenna operating at a wavelength X the gain of the antenna is given by ***G*** - — j ^ — where ***Ajf*** is the effective antenna aperture. Establish the relation. Find gain for a parabolic reflector of aperture diameter 10 cm and operating at a frequency 10 GHz.

8. Describe the structure, frequency of operation, working principle and application of any two of the following antennas.
(i) Rhombic antenna; (ii) Lot periodic antenna; (iii) Horn antenna.