Ref: Ex/ET/PC/B/T/314/2024

BETCE 3rd Year, 1st Semester Examination 2024

Subject: Antennas & propagation

Time 3 hrs. **Full Marks: 100**

Antenna

Answer any three questions from Q1-Q4

Q.1 **10+5+5=20**

a. Explain the Larmor's equation by deducing total power radiated from perpendicular electric field in non relativistic domain.
b. Draw the voltage and current distribution of a dipole having length $\lambda/4<l<\lambda/4$ and $\lambda/2<l<3\lambda/2$. Justify your answer.
c. Proof Lorentz Gauge condition.

Q.2 **5+5+ 10=20**

a. A dipole antenna of length 3 meter operates at 3MHz is designed from copper wire of 1mm radius. Find the radiation efficiency if the conductivity of copper is 5.7×10^6 S/m. Take μ_0 as its standard value.
b. A magnetic field of strength $6\mu A/m$ is required at a point of $\theta=\pi/2$ and R= 2.5km from a half-wave dipole antenna. Find out the transmitted power.
c. Deduce the value of radiation resistance for a Hertzian dipole.

Q.3 **5+10+5=20**

a. What are the basic feeding differences in YagiUda array and Log Periodic array?
b. Deduce the Array factor, FNBW, Side lobe levels for an N element broad side antenna array
c. A broadside array of point source is operating at 5GHz. Find out FNBW and directivity of the array if the array length is 15 meter.

Q.4 **8+8+4=20**

a. Proof that a plane wave radiating from a dipole antenna is an electromagnetic wave.
b. Explain the operation of parabolic reflector and how the feed position can be changed to avoid shading.
d. What is relationship between Gain and Directivity of an antenna?

[Turn over

Propagation

Answer any two questions from Q.5-Q.7

Q.5 **5+5+6+4=20**

a. What are the preferred mode of communication for UHF and VHF?

b. Explain the attenuation characteristics of environment in terms of frequency of signal.

c. Power transmitted from a transmitter is 10kW and the gain of transmitting and receiving antennas are 30dB and 20 dB respectively then calculate maximum power received at a distance of 10km over a free space for 2GHz transmission frequency.

d. Justify that reflection coefficient is a complex quantity in terms of two layer interface circuit

Q. 6 **3+3+7+7=20**

a. Define flat earth condition.

b. What is meaning of coverage diagram.

c. Deduce the generalized expression of path gain factor for antennas located on flat earth.

d. Deduce the expression of refractive index of Ionosphere.

Q.7 **10+5+5 = 20**

a. Explain the Fresnel's diffraction and explain Cornu spiral.

b. What is plasma frequency in ionosphere?

c. F2 layer of ionosphere has electron density of 0.81×10^{12} electrons/ m^3 at a height of 350 km from earth's surface. Find critical frequency of this layer. Also find out MUF for two stations located at a separation of 1500 km. Choose flat earth.