Ref: Ex/ET/PC/B/T/314/2024(S)

BETCE 3rd Year, 1st Semester Supplementary Exam 2024

Subject: Antennas & propagation

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

Antenna

Answer All Questions

Q.1 (CO-1) **10+8+2=20**

a. Explain the Larmor's equation by deducing total power radiated from perpendicular electric field in non relativistic domain.
b. Proof that a plane wave radiating from a dipole antenna is an electromagnetic wave.
c. What is the significance of curl less field .

Q.2 (CO-2) **5+5+ 10=20**

a. What is relationship between Gain and Directivity of an antenna.
b. A magnetic field of strength 6μA/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 (CO-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 End fire antenna array
c. Explain the operation of parabolic reflector and how the feed position can be changed to avoid shading.

Propagation

Answer All Questions

Q.4 (CO-4) **5+5+6+4=20**

a. What are the preferred modes of Submarine communication?
b. Explain the attenuation characteristics of environment in terms of frequency of signal.
c. A radio station has an EIRP of 25 kW and a transmit power of 1.73 kW. What is the gain of the antenna?.
d. Justify that reflection coefficient is a complex quantity in terms of two layer interface circuit

[Turn over

Q.5 (CO-5) **10+5+5 = 20**

a. Define MUF. Proof that f_{MUF} for short distance communication is $f_{MUF} = f_c . \sqrt{1 + \frac{D^2}{4h^2}}$.

b. What is plasma frequency in ionosphere?

c. F2 layer of ionosphere has electron density of 0.81 x 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.

Student should able to

CO-1: Identify the fundamental principle of EM radiation and its effect on antenna characteristics. (K1)

CO-2: Solve the field equations of different antenna structures by using numerical technique. (K2)

CO-3: Analyze and predict the applications of single element antenna in array domain. (K4)

CO-4:Examine the effects of electromagnetic signal propagation at multiple boundaries and edges of planes (K1, A2)

CO-5: Identify and demonstrate the different methods of wave propagation and estimation of link budget (K2)