

BETCE 3rd Year, 1st Semester Examination 2025

Subject: Antennas & propagation

Time 3 hrs.

Full Marks: 100

Antenna

Answer any three questions from Q1-Q4

Q.1

CO-1

10+5+5=20

- a. An electric field provides oscillation over an electron and having mass m , charge q . With an analogy to simple harmonic motion prove that time average scattering power related with ω^4 . Draw and explain the amplitude variation of the solution expression with resonance.
- b. Draw the voltage and current distribution of a dipole having length $\lambda/4 < l < \lambda/2$ and $\lambda/2 < l < 3\lambda/2$. Justify your answer.

Q.2

CO-2

6+6+ 8=20

- a. A half-wave dipole antenna operates at a frequency of 30 MHz. The antenna is made of an aluminum wire with a radius of 0.5 mm and conductivity $\sigma = 3.8 \times 10^7$ S/m. The radiation resistance is 73Ω , and the input resistance, including loss, is measured as 100Ω . Given the half-wave dipole's maximum directivity of 2.15 dBi, find the gain of the antenna in decibels (dB).
- b. Radiation efficiency of an antenna is 90%. The maximum radiation intensity is 0.7 W/Sr. Calculate the directivity of antenna if $P_{in} = 0.4$ W
- c. Deduce the value of radiation resistance for a Hertzian dipole.

Q.3

CO-3

10+6+4=20

- a. Calculate the direction of null for n element End fire array having 'd' as inter-element spacing.
- b. An end-fire array of 8 isotropic point sources is operating at 3 GHz with a spacing of 0.5λ between the elements. Calculate the positions of the nulls in the radiation pattern.
- c. Explain the operation of Log Periodic antenna array and its feed diagram.

Q.4

8+8+4=20

- a. Prove that a plane wave radiating from a dipole antenna is an electromagnetic wave. **CO-1**
- b. Explain the operation of parabolic reflector and how the feed position can be changed to avoid shading. **CO-2**
- d. Explain the operation of folded dipole and what is the advantage of folded dipole? **CO-3**

[Turn over

Propagation

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

Q.5

CO-4

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. Proof that to have proper radio horizon earth radius need to be increased virtually by an amount of $4/3$.
- 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. **CO-5**
- b. What is meaning of coverage diagram. **CO-4**
- c. Deduce the generalized expression of path gain factor for antennas located on flat earth. **CO-4**
- d. Explain the Fresnel's diffraction and explain Cornu spiral. **CO-5**

Q.7

CO-5

10+5+5 = 20

- a. Deduce the refractive index of ionosphere.
- 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.