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B.TECH
(SEM VI) THEORY EXAMINATION 2022-23
ANTENNA AND WAVE PROPAGATION

Time: 3 Hours ***Total Marks: 100***

Note: Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt *all* questions in brief. **2 x 10 = 20**

a. Evaluate points (0, -4, 3) into cylindrical and spherical coordinate system.

b. Illustrate the gradient of a vector in cylindrical coordinate system.

c. Illustrate Maxwell's equation for electric field.

d. Discuss equation of continuity and its application.

e. Describe the Beam Area of an Antenna and give the formula.

f. Define gain and directivity of an antenna.

g. Define radiation resistance of Antenna.

h. Illustrate long wire antenna.

i. Evaluate the maximum range of a tropospheric transmission for which the transmitting antenna height is 100ft and receiving antenna height is 50 ft.

j. Evaluate the maximum electron concentration of the D layer and E layer has critical frequencies 2.5MHz and 8.4MHz respectively.

SECTION B

2. Attempt any *three* of the following: **10x3=30**

a. Evaluate vector $\mathbf{A}= \rho z\sin\phi \mathbf{a}_\rho + 3\rho\cos\phi \mathbf{a}_\phi + \rho\sin\phi\cos\phi\ \mathbf{a}_z$ into Cartesian coordinate system.

b. Demonstrate boundary conditions for electric field intensity and electric flux density for various types of medium.

c. An antenna has a field pattern given by $E(\theta)= \cos^2\theta$ for $0^o \leq \theta \leq 90^o$. Evaluate the
i. HPBW
ii. FNBW
iii. Beam Area
iv. Draw the pattern showing HPBW and FNBW.

d. Demonstrate vertical antenna and folded dipole antennas.

e. Demonstrate critical frequency, multihop propagation and skip distance for sky wave propagation

SECTION C

3. Attempt any *one* part of the following: 10x1=10

a. Illustrate differential length, area and volume in Cartesian coordinates and cylindrical coordinates system with neat sketch.

b. Evaluate divergence for P= $yz\mathbf{a}_x + 4xy\mathbf{a}_y + y\mathbf{a}_z$ at point (1, -2, 3).Also evaluate curl for the same and compare results.

4. Attempt any *one* part of the following: 10x1=10

a. Design a 3 elements yagi-uda Antenna. Demonstrate the length of elements and the distances between them.

b. Evaluate electric filed intensity on a point P due to semi-infinite line.

5. Attempt any *one* part of the following: 10x1=10

a. Illustrate effective aperture and effective height of an antenna. Also discuss antenna temperature.

b. Design a radio communication link for directional antennas. Evaluate the power delivered to the receiver if a radio link has a 15W transmitter connected to an antenna of $1.5m^2$ at 3 GHz. The receiving antenna has an effective aperture of $0.5m^2$and is located at a 15km line of sight distance from the transmitting antenna. Assuming lossless, matched antennas.

6. Attempt any *one* part of the following: 10x1=10

a. Evaluate electric field due to array of two λ/2 driven element when current of equal amplitude and same phase is flowing in antennas.

b. Derive expression of electric field due to short dipole.

7. Attempt any *one* part of the following: 10x1=10

a. Derive equation for maximum usable frequency for both flat and curved earth condition.

b. Demonstrate ground wave propagation and space wave propagation.