



Paper ID : 261886

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Subject Code: BEC603

Roll No:

BTECH

(SEM. VI) THEORY EXAMINATION 2025-26

ANTENNA AND WAVE PROPAGATION

TIME: 3 HRS

M.MARKS: 70

Note: Attempt all Sections. In case of any missing data; choose suitably.

SECTION A

1. Attempt *all* questions in brief.

02 x 7 = 14

Q no.	Question	CO	Level
a.	Explain the transformation between Cartesian and Cylindrical coordinate systems.	1	K2
b.	Convert the point $(x,y,z)=(3,3,3)$ into spherical coordinates. Show all steps.	1	K3
c.	Write expressions for differential length, area, and volume elements in Cartesian coordinate system.	1	K2
d.	Define gradient and divergence.	1	K2
e.	State and explain the Divergence Theorem.	1	K3
f.	Define curl of a vector field.	1	K2
g.	State Stokes' Theorem and explain its physical significance.	1	K2

SECTION B

2. Attempt any *three* of the following:

07 x 3 = 21

Q no.	Question	CO	Level
a.	Define electric field intensity and electric flux density. State Gauss's Law in both integral and differential forms (Maxwell's equation). Use Gauss's Law to find the electric field due to a uniformly charged infinite plane sheet.	2	K2
b.	Explain the continuity equation and derive its form from charge conservation. Define relaxation time and explain its physical significance. State the boundary conditions for electric fields at the interface of two dielectric media.	2	K2
c.	State and explain Ampere's Circuital Law. Define magnetic scalar and vector potentials. Write down Maxwell's equations in final (point) form and explain their significance in electromagnetic theory.	2	K2
d.	A long straight conductor carries a current of $I=10$ A. Find the magnetic field intensity at a distance of $r=0.05$ m from the conductor using Ampere's Law.	2	K3
e.	A uniformly charged sphere of radius $R=0.2$ m has a total charge $Q=5 \times 10^{-6}$ C. Find the electric field intensity: (a) at a point inside the sphere at $r=0.1$ m (b) at a point outside the sphere at $r=0.5$ m	2	K3

SECTION C

3. Attempt any *one* part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Define and explain: i. Antenna aperture and effective aperture ii. Effective height of an antenna Describe the radio communication link, including the role of transmitting and receiving antennas.	3	K2



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	Explain the importance of Signal-to-Noise Ratio (SNR) in communication systems.		
b.	Define the following antenna parameters: i. Radiation intensity ii. Beam solid angle Ω_A iii. Directivity An antenna has a beam solid angle of $\Omega_A=0.5$ steradians . Calculate the directivity of the antenna and comment on its performance.	3	K3

4. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Discuss: i. Antenna temperature ii. Antenna impedance Explain how these parameters affect the performance of an antenna system.	3	K2
b.	Explain the fields radiated by an oscillating dipole antenna. A dipole antenna has a radiation resistance of 73Ω and loss resistance of 7Ω . Find: (i) The antenna impedance (ii) The efficiency of the antenna	3	K3

5. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Explain the construction and working of a half-wave ($\lambda/2$) dipole antenna. Derive its radiation resistance. A half-wave dipole antenna has a radiation resistance of 73Ω . If the antenna is fed with a current of $I=1.5$ A, calculate: (a) The power radiated (b) If loss resistance is 5Ω , find the antenna efficiency	4	K3
b.	Describe the design and working of: i. Yagi-Uda antenna ii. Folded dipole antenna Discuss their applications and advantages.	4	K2

6. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	Explain plane earth reflection mechanism. Derive the field strength relation for space wave propagation considering direct and reflected waves. Discuss the effect of interference between the two waves.	5	K3
b.	Describe the structure of the ionosphere with different layers. Explain the mechanism of sky wave propagation and how waves are refracted back to earth.	5	K2

7. Attempt any one part of the following:

07 x 1 = 07

Q no.	Question	CO	Level
a.	The critical frequency of an ionospheric layer is $f_c=5$ MHz . If the angle of incidence is 30° , calculate the Maximum Usable Frequency (MUF) . Also explain the significance of MUF, LUF, and OF in communication.	5	K4
b.	Explain multi-hop propagation with neat diagrams. Discuss important wave characteristics affecting sky wave communication such as: i. Fading ii. Absorption iii. Polarization	5	K3