Printed Page:- 04 **Subject Code:- AEC0503**

Roll. No:

NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - THEORY EXAMINATION DEC (2024 - 2025)

Subject: Electromagnetic Field Theory and Antenna

Time: 3 Hours **Max. Marks: 100**

General Instructions:

IMP: *Verify that you have received the question paper with the correct course, code, branch etc.*

1. *This Question paper comprises of* ***three Sections -A, B, & C.*** *It consists of Multiple Choice Questions (MCQ's) & Subjective type questions.*

2. *Maximum marks for each question are indicated on right -hand side of each question.*

3. *Illustrate your answers with neat sketches wherever necessary.*

4. *Assume suitable data if necessary.*

5. *Preferably, write the answers in sequential order.*

6. *No sheet should be left blank. Any written material after a blank sheet will not be evaluated/checked.*

SECTION-A 20

1. Attempt all parts:-

1-a. Line integral is used to calculate(CO1,K1) 1

(a) Volume
(b) Area
(c) Length
(d) None of the above

1-b. The divergence theorem relates(CO1,K1) 1

(a) a line integral over a closed line to a surface integral
(b) a surface integral over a closed surface to a line integral
(c) a surface integral over a closed surface to a volume integral
(d) None of the above

1-c. Coulomb law is employed in (CO2,K1) 1

(a) Electrostatics
(b) Magnetostatics
(c) Maxwell theory
(d) None of the above

1-d. Unit of electric flux is (CO2,K1) 1

(a) Coulomb
(b) Weber
(c) Tesla

(d) Weber/m

1-e. In good conductor the attenuation constant is ____ the phase constant. (CO3, K1) 1

(a) more than
(b) less than
(c) equal to
(d) not equal to

1-f. _____ states that the net power flowing out of a given volume v is equal to the time rate of decrease in the energy stored within v minus the ohmic losses. (CO3, K1) 1

(a) Gauss's law
(b) Poynting's theorem
(c) Faraday's law
(d) Stokes's theorem

1-g. An ideal source in which the power is radiated equally in all directions is known as ____radiator.(CO4, K1) 1

(a) Isotropic
(b) Omni-directional
(c) Directional
(d) Transducer

1-h. The power pattern of an antenna is (CO4, K1) 1

(a) Directly proportional to the square of the field pattern
(b) Inversely proportional to the field pattern
(c) Directly proportional to the field pattern
(d) Inversely proportional to the square of the field pattern

1-i. The helical antenna working in _____ mode, if circumference of helix is equal to one wavelength. (CO5, K1) 1

(a) Axial mode
(b) Normal mode
(c) Conical mode
(d) Both axial & normal mode

1-j. Cassegrain feed is used with a parabolic reflector to (CO5, K1) 1

(a) increase the gain of the system
(b) increase the beamwidth of the system
(c) reduce the size of the main reflector
(d) allow the feed to be placed at a convenient point

2. Attempt all parts:-

2.a. Define surface area in spherical Coordinate. (CO1, K1) 2

2.b. State Biot-Savart's law. (CO2,K1) 2

2.c.	Write the Maxwell electromagnetic equations in time-varying fields. (CO3, K2)	2
2.d.	Briefly describe antenna radiation pattern. (CO4, K1)	2
2.e.	Enlist the applications of microstrip antenna. (CO5, K2)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Explain Cartesian coordinates and write its conversion in Cylindrical and Spherical coordinates. (CO1, K2)	6
3-b.	Convert points P (1,3,5) and T (0, -4,3) from Cartesian to cylindrical and spherical coordinates. (CO1, K2)	6
3-c.	Derive the expression for the electric field intensity for an infinite line charge having uniform charge density ρ_L.(CO2, K3)	6
3-d.	Explain Ampere's circuit law. (CO2, K2)	6
3.e.	Find the radiation resistance of current element, whose overall length is $\lambda/100$ and $\lambda/50$. (CO3, K2)	6
3.f.	Explain the effective aperture of the receiving antenna in context of Poynting theorem.(CO4)	6
3.g.	Discuss about the applications of loop antenna & what is 180-degree ambiguity? How it arises and how is it removed?	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Describe the properties of the curl and determine the curl of vector fields $a_x - ya_y + (4y-z)a_z$, $10a_x - 2a_y - 11a_z$.(CO1, K2)	10
4-b.	Explain the Laplacian equation in all three coordinate systems and find the Laplacian of the scalar field $V= \rho z^2 \sin 2\phi$.(CO1, K2)	10

5. Answer any one of the following:-

5-a.	State and explain Gauss's law. Prove that div $D= \rho_v$ for an electrostatic field, Where D is the electric flux density and ρ_v is the volume charge density. (CO2, K2)	10
5-b.	State and explain the Maxwell's equations in differential and integral form. (CO2, K2)	10

6. Answer any one of the following:-

6-a.	Explain Poynting Vector. Derive an expression of Poynting theorem for EM wave and also explain the significance of each term of the expression. (CO3, K1)	10
6-b.	Explain intrinsic impedance of a medium and derive intrinsic impedance for plane waves in lossless dielectrics. (CO3, K2)	10

7. Answer any one of the following:-

7-a.	Discuss radio communication link and derive the FRIIS transmission formula mathematically and also path loss. (CO4, K3)	10
7-b.	Explain the antenna aperture in detail and also derive an expression showing the	10

relation between effective aperture and directivity of an antenna. (CO4, K2)

8. Answer any <u>one</u> of the following:-

8-a.	Describe Log periodic antenna with suitable design equations and working. (CO5, K1)	10
8-b.	Describe the principle of direction finding by means of a closed loop antenna and give the expression for the induced voltage and field strength for short loop and large loop. (CO5, K2)	10