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. Which of the following theorem convert line integral to surface integral? (CO1, K1) 1

(a) Divergence theorem

(b) Stoke's theorem

(c) Both Divergence and Stoke's theorem

(d) None of the above

1-b. The divergence of the Gradient of a scalar field is known as: (CO1, K1) 1

(a) Curl

(b) Vector Gradient

(c) Laplacian

(d) None of the above

1-c. What is the force (in Newton) on a charge 2C in a field 1V/m? (CO2, K1) 1

(a) 0

(b) 1

(c) 2

(d) 3

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

(a) Coulomb

(b) Weber

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(c) Tesla

(d) Weber/m

1-e. The concept of displacement current was a major contribution attributed to (CO3, K1) 1

(a) Faraday

(b) Lenz

(c) Maxwell

(d) Lorenz

1-f. The attenuation constant in free-space is (CO3, K1) 1

(a) more than one

(b) less than one

(c) one

(d) zero

1-g. The beam-width and the directivity of an antenna are(CO4, K1) 1

(a) Directly proportional

(b) Inversely proportional

(c) Independent of each other

(d) Equal

1-h. The radiation focusing capability of an antenna is known as (CO4, K1) 1

(a) Efficiency

(b) Stray factor

(c) Directivity

(d) Impedance

1-i. A 5 turn axial mode helical antenna has directivity of 24 dBi, the axial ratio of this antenna is 1

(a) 1.21

(b) 1.1

(c) 1

(d) 5

1-j. The most commonly used horn is (CO5, K1) 1

(a) H-plane sectoral horn

(b) E-plane sectoral horn

(c) Pyramidal horn

(d) Conical horn

2. Attempt all parts:-

2.a. Transform the point P (5,3,6) in cylindrical coordinate system. (CO1, K1) 2

2.b. Define volume charge density.(CO2, K1) 2

2.c. Find the strength of a magnetic field H in free space, If the electric field strength 2

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of a plane wave is 1V/m. (CO3, K1)

2.d. The radiation resistance of an antenna is 72 Ω and loss resistance is 8 Ω. Find the directivity, if the gain is 16. (CO4, K2) 2

2.e. Explain the application of loop antenna as a direction finders. (CO5, K2) 2

SECTION-B 30

3. Answer any five of the following:-

3-a. Find the gradient of the scalar field W= $10r \sin^2\theta\cos\phi$. (CO1, K1) 6

3-b. Using the differential length dl, find the length of $\rho=3$, $\pi/4 < \phi < \pi/2$, z= constant. (CO1, K1) 6

3-c. Explain the tangential and normal boundary conditions between two dielectrics for static electric fields. (CO2, K2) 6

3-d. Explain Biot Savart's Law.(CO2, K1) 6

3.e. Show that the ratio of conduction current density to displacement current density is equal to $\sigma/\omega\varepsilon$, where σ = conductivity of the medium, ε = permittivity of the medium, ω = angular frequency. (CO3, K2) 6

3.f. Define directivity of an antenna and find the relationship between directivity and gain of antenna. 6

3.g. Design a Horn antenna. 6

SECTION-C 50

4. Answer any one of the following:-

4-a. Illustrate line, surface and volume integrals. (CO1, K1) 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= ρ_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. Derive an expression for continuity equation and relaxation time. (CO2,K2) 10

6. Answer any one of the following:-

6-a. State and explain Maxwell's equations for time varying fields in differential and integral forms and their significance. (CO3, K2) 10

6-b. Explain the plane wave in free space. (CO3, K2) 10

7. Answer any one of the following:-

7-a. Define the Antenna gain and also discuss various types of directional parameters of an antenna. Corelate them in terms of Antenna efficiency. (CO4, K2) 10

7-b. Discuss radio communication link and derive the FRIIS transmission formula mathematically and also path loss. (CO4, K3) 10

8. Answer any one of the following:-

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8-a.	What is the condition of frequency independence in antennas. Explain the log periodic antenna using proper diagram and expressions. (CO5, K3)	10
8-b.	Explain the structure of microstrip antenna. Discuss its feed mechanism and application. (CO5, K2)	10

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