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 (2023 - 2024)

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) 1

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

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

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

1-d. The electric field intensity is defined as (CO2) 1

(a) force per unit charge
(b) force per unit area
(c) force per unit volume

(d) force per unit length

1-e. The radiation resistance of current element, whose overall length is $\lambda/10$, is (CO3) 1

(a) 0.078 Ω
(b) 0.789 Ω
(c) 78.95 Ω
(d) 7.895 Ω

1-f. The directivity of half wave dipole antenna is (CO3) 1

(a) 1.76 dB
(b) 2.15 dB
(c) 2.04 dB
(d) 5.2 dB

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

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

1-h. The beam area and the directivity of an antenna are (CO4) 1

(a) Directly proportional
(b) Inversely proportional
(c) Independent of each other
(d) Equal

1-i. The helical antenna working in _____ mode, if circumference of helix(C) <<λ. 1

(a) Axial mode
(b) Normal mode
(c) Conical mode
(d) None of these

1-j. Cassegrain feed is used with a parabolic reflector to (CO5) 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. Express the point P(1, -4 , -3) in cylindrical coordinate.(CO1) 2

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

2.c. Enlist the three fundamental characteristics of Electromagnetic energy. (CO3) 2

2.d.	Define radiation Intensity.(CO4)	2
2.e.	Explain the application of loop antenna as a direction finders.(CO5)	2

SECTION-B 30

3. Answer any five of the following:-

3-a.	Prove that, the curl of the gradient of any scalar field vanishes.(CO1)	6
3-b.	Explain gradient and write the equation of gradient in Cartesian, cylindrical and spherical coordinates.(CO1)	6
3-c.	Show that the electric field strength at any point due to an infinite sheet of charge is independent of the distance from the sheet. (CO2)	6
3-d.	Explain the Coulomb's law and Biot Savart's law in brief. (CO2)	6
3.e.	Show that the directivity of an alternating current element is 1.76 dB. (CO3)	6
3.f.	Explain the effective aperture of the receiving antenna in context of Poynting theorem.(CO4)	6
3.g.	Illustrate with neat diagram and design equations the working of Log-periodic antenna.(CO5)	6

SECTION-C 50

4. Answer any one of the following:-

4-a.	Illustrate line, surface and volume integrals.(CO1)	10
4-b.	Illustrate Stokes theorem and Divergence Theorem.(CO1)	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)	10
5-b.	State & prove Ampere circuital law. Using this law, Derive an expression of magnetic field intensity, H due to infinite sheet of current. (CO2)	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)	10
6-b.	Using the concept of Maxwell's equation explain how waves propagates in guided waves.(CO3)	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)	10
7-b.	Define radiation intensity of an antenna. Derive the expression between Poynting Vector and Radiation Intensity. Also discuss the Directivity and Antenna gain in terms of Radiation Intensity.(CO4)	10

8. Answer any one of the following:-

8-a.	Discuss the various parameters used in the design of Helical Antenna. Explain the working and operation of a helical antenna to define the process to produce the circularly polarized waves.(CO5)	10

8-b. What is the condition of frequency independence in antennas. Explain the log periodic antenna using proper diagram and expressions.(CO5) 10