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NOIDA INSTITUTE OF ENGINEERING AND TECHNOLOGY, GREATER NOIDA

(An Autonomous Institute Affiliated to AKTU, Lucknow)

B.Tech

SEM: V - CARRY OVER THEORY EXAMINATION - APRIL 2023

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. In free space, the electric flux density is equal to (CO2) 1
- (a) μ_0 times the electric field intensity
 - (b) μ_0 times the magnetic field intensity
 - (c) ϵ_0 times the electric field intensity
 - (d) ϵ_0 times the magnetic field intensity
- 1-e. The unit of electric field intensity is (CO3) 1
- (a) V/Sq m
 - (b) V/m
 - (c) A/m
 - (d) A/Sq m
- 1-f. Radiation resistance of a thin, linear, center-fed, $\lambda/2$ antenna with sinusoidal current distribution is (CO3) 1
- (a) 70 Ω
 - (b) 73 Ω
 - (c) 80 Ω
 - (d) 83 Ω
- 1-g. In dBi, i indicates (CO4) 1
- (a) Electric current
 - (b) Isotropic
 - (c) Dipole
 - (d) Isomer
- 1-h. The directivity of an isotropic antenna is (CO4) 1
- (a) 1
 - (b) 1.5
 - (c) 2
 - (d) 1.64
- 1-i. At 20 GHz, the gain of a parabolic dish antenna of 1-meter diameter and 70% efficiency is (CO5) 1
- (a) 10 dB
 - (b) 30 dB
 - (c) 40 dB
 - (d) 45 dB

1-j.	The most commonly used horn is (CO5)	1
	(a) H-plane sectoral horn	
	(b) E-plane sectoral horn	
	(c) Pyramidal horn	
	(d) Conical horn	

2. Attempt all parts:-

2.a.	State stokes theorem.(CO1)	2
2.b.	State Ampere's circuit law. (CO2)	2
2.c.	Briefly describe the Poynting's theorem. (CO3)	2
2.d.	Briefly explain radiation resistance.(CO4)	2
2.e.	Explain the applications of Loop Antenna.(CO5)	2

SECTION B

30

3. Answer any five of the following:-

3-a.	Prove that the divergence of the curl of any vector field is zero.(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 Biot Savart's Law.(CO2)	6
3.e.	Find the radiation resistance of current element, whose overall length is $\lambda/100$ and $\lambda/50$.(CO3)	6
3.f.	Explain the effective aperture of the receiving antenna in context of Poynting theorem.(CO4)	6
3.g.	Write a short note on Microstrip antenna. (CO5)	6

SECTION C

50

4. Answer any one of the following:-

4-a.	Explain the various types of charge distribution with examples.(CO1)	10
4-b.	Express the following points in Cartesian coordinates:(CO1)	10
	a. P (1, 60°, 2)	
	b. Q (2, 90°, -4)	
	c. R (3, 45°, 210°)	

d. $T(4, \pi/2, \pi/6)$

5. Answer any one of the following:-

- 5-a. State and explain the Maxwell's equation in differential and integral form.(CO2) 10
- 5-b. Write a short note on (CO2) 10
- a. Magnetic field intensity
 - b. Magnetic Flux density
 - c. Vector magnetic potential
 - d. Scalar Magnetic potential

6. Answer any one of the following:-

- 6-a. Explain intrinsic impedance of a medium and derive intrinsic impedance for plane waves in lossless dielectrics.(CO3) 10
- 6-b. Explain displacement current and derive Ampere's law for time varying field.(CO3) 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) 10
- 7-b. Explain effective height of an antenna. Derive the relation between directivity and beam solid angle.(CO4) 10

8. Answer any one of the following:-

- 8-a. Describe Log periodic antenna with suitable design equations and working.(CO5) 10
- 8-b. Describe the parabolic antenna used at microwave frequencies. Describe the method of feeding a paraboloid reflector in which the primary antenna is located at the focal point. (CO5) 10