GURU NANAK INSTITUTE OF TECHNOLOGY
An Autonomous Institute under MAKAUT
2021
ANTENNA AND WAVE PROPAGATION
EC404

TIME ALLOTTED: 3 HOURS **FULL MARKS: 70**

The figures in the margin indicate full marks.
Candidates are required to give their answers in their own words as far as practicable

GROUP – A
(Multiple Choice Type Questions)

Answer any *ten* from the following, choosing the correct alternative of each question: **10×1=10**

			Marks	CO No.
1.	(i)	Polarization refers to the orientation of the	1	2
		a) E-H fields		
		b) H-field		
		c) Transverse E-field		
		d) E-field		
	(ii)	In a non-isotropic directional antenna, which radiating lobe axis makes an angle of 180° w.r.t. major beam of an antenna?	1	3
		a) Major lobe		
		b) Side lobe		
		c) Back lobe		
		d) None of these		
	(iii)	The rate of energy flow is given by	1	2
		a) Maxwell equation		
		b) Poynting vector		
		c) Poisson equation		
		d) Equation of continuity		
	(iv)	The far field of an antenna varies with distance 'r' as	1	3
		a) $1/r$		
		b) $1/r^2$		
		c) $1/r^3$		
		d) $1/\sqrt{r}$		
	(v)	The range of the standing wave ratio is	1	1
		a) $0 < S < 1$		
		b) $-1 < S < 1$		
		c) $1 < S < \infty$		
		d) $0 < S < \infty$		
	(vi)	Given that the reflection coefficient is 0.6. Find the SWR.	1	2
		a) 2		
		b) 4		
		c) 6		
		d) 8		
	(vii)	Yagi-Uda antenna is one kind of	1	3
		a) array		
		b) reflector		
		c) dipole		
		d) none of these		

			Marks	CO No
(viii)	Intrinsic impedance in free space is a) 0 ohm b) 370 ohm c) 377 ohm d) none of these		1	2
(ix)	Directivity of half wave dipole antenna is a) 0 b) 1.64 c) 10.2 d) -3.0		1	4
(x)	The permeability of free space is a) zero H/m b) ∞ c) $4\pi \times 10^{-7}$ H/m d) 8.75×10^{12} H/m		1	2
(xi)	Distortion less condition for a transmission line is a) LG = RC b) LR = GC c) GR = LC d) LC= Q		1	2
(xii)	Intrinsic impedance of a lossy dielectric is given as		1	4

a) $\sqrt{\dfrac{j\omega\varepsilon}{\sigma + j\omega\mu}}$

b) $\sqrt{\dfrac{j\omega\mu}{\sigma + j\omega\varepsilon}}$

c) $\sqrt{\dfrac{\sigma + j\omega\mu}{j\omega\varepsilon}}$

d) $\sqrt{\dfrac{\sigma + j\omega\varepsilon}{j\omega\mu}}$

GROUP – B
(Short Answer Type Questions)
Answer any *three* from the following: **3×5=15**

			Marks	CO No
2.	(a)	A loss less transmission line of length 100 m has an inductance of 28 μH and a capacitance of 20 μF and excited at 100 KHz. Find i. Propagation velocity ii. Phase constant	5	CO1
3.	(a)	Explain the importance of Friis equation in antenna based communication system.	4	CO2
	(b)	What is the nature of radiation pattern of an isotropic antenna?	1	CO3
4.	(a)	What is Hertzian dipole?	1	CO3
	(b)	Find the directive gain and the directivity of a Hertzian dipole.	4	CO3
5.	(a)	Express the Maxwell's equations and give interpretation.	4	CO2
	(b)	What is the relation between decibel and neper ?	1	CO2
6.	(a)	State and explain boundary conditions at the interface of two media.	4	CO2
	(b)	Write down two applications of reflector antenna.	1	CO3

GROUP – C
(Long Answer Type Questions)
Answer any *three* from the following: **3×15=45**

			Marks	**CO No.**
7.	(a)	Derive Helmholtz's equation for time harmonic electromagnetic wave from Maxwell's Equation.	5	CO1
	(b)	Solve Helmholtz's equation in good conductor. Derive the expressions of attenuation and phase constant.	5	CO1
	(c)	$\mathbf{E} = 16e^{-0.05x} \sin(2\times10^8 t - 2x)\ \mathbf{a_z}$ V/m find: (a) the propagation constant, (b) the wavelength, (c) the speed of the wave, (d) the skin depth.	5	CO1
8.	(a)	The electric field of a plane wave in free space is represented by $E = 10\hat{y}\cos(10^9 t + 30z)$ V/m. Determine the magnetic field $\vec{H}$	4	CO2
	(b)	Find the Phase velocity of the wave and . dielectric constant of the medium, where $\mu = \mu_0$	6	CO2
	(c)	Find the power flow per unit area.	5	CO2
9.	(a)	What is Transmission Line? Derive the expression for voltage signal in Transmission line.	6	CO1
	(b)	A distortion-less line operating at 500 MHz has $Z_0 = 80\ \Omega$, $\alpha = 0.04$ Np/m, $\beta = 1.5$ rad/m. Find the line parameters R,L,G and C.	4	CO1
	(c)	What is a standing wave and explain how it is produced?	5	CO1
10.	(a)	State and explain Gauss Law in differential and integral form by application of Divergence theorem.	6	CO1
	(b)	Define and explain the following terms- (i) Beamwidth (ii) Radiation resistance (iii) Gain of an antenna	6	CO3
	(c)	If an antenna draws 10 A current and radiates power 2 kW, then what will be its radiation resistance (in Ω)?	3	CO3
11.		Write short notes on *any three* of the following:	3X5=15	
	(a)	Smith chart	5	CO1
	(b)	Faraday's laws of electromagnetic induction	5	CO1
	(c)	Near and far field of an antenna	5	CO4
	(d)	Maxwell's Equations in integral form	5	CO3
	(e)	Log periodic antenna	5	CO3