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K. J. Somaiya Institute of Engineering and Information Technology, Sion, Mumbai-22

(Autonomous College Affiliated to University of Mumbai)

End Semester Exam

Nov-Dec
2022

Program: B.Tech. (Electronics and Telecommunication)

Examination: TY Semester: VI

Course Code: 1UEXC601 and Course Name: Electromagnetic and Antenna

Duration: 03 Hours

Max. Marks: 60

Instructions:

- (1) All questions are compulsory.
- (2) Draw neat diagrams wherever applicable.
- (3) Assume suitable data, if necessary.

		Max. Marks	CO	BT level
Q 1	Solve any six questions out of eight:	12		
i)	Explain Continuity equations.	2	1	U
ii)	Explain boundary conditions of E and H fields for two media.	2	2	U
iii)	List salient features of Microstrip antenna.	2	6	U
iv)	Describe five controls of array antenna	2	6	U

v)	The transmission line is connected to a transmission line load impedance $10+j20$ at 2 GHz. Find the reflection coefficient (i) at the load end of the line (ii) at a distance of 20 cm from the load.	2	3	Ap
vi)	Explain isotropic antenna, Omni-directional antenna and directional antenna.	2	5	U
vii)	Describe ground wave propagation in short.	2	4	U
viii)	Explain the concept of potential gradient and the relation between electric field and potential.	2	1	U
Q.2	Solve any four questions out of six.	16		
i)	Derive expressions of radiation resistance of half wavelength dipole antenna. Why, actual $\lambda/2$ length of half wavelength dipole antenna is lies between 0.47λ to 0.48λ instead of 0.5λ .	4	5	Ap
ii)	Describe formation of ionized layer in the ionosphere and describe their importance in radio communication. Define critical frequency & Maximum usable frequency.	4	4	U
iii)	Derive Maxwell's equation for time varying fields in point and integral form and explain its significance.	4	2	Ap
iv)	What is the significance of beam width of antenna? If HPBW of directional antenna in E-plane and H-plane is 30° and 45° respectively, calculate directivity and gain of the same antenna. (Assume radiation efficiency =55%).	4	5	Ap
v)	Derive boundary conditions for electrostatics and magnetostatics.	4	2	U
vi)	Calculate the attenuation constant and phase constant for	4	4	Ap

	the uniform plane wave with the frequency of 10 GHz in a medium for which $\mu=\mu_0$, $\epsilon_r=2.3$ and $\sigma=2.54\times 10^{-4}/m$.			
Q.3	Solve any two questions out of three.	16		
i)	Explain log periodic antenna in detail. Design a log periodic dipole antenna to operate in the frequency range of 80 MHz to 120 MHz, considering scale factor of 1.2.	8	6	Ap
ii)	Derive the expression for Friis transmission equation and state its significance in wireless communication.	8	4	An
iii)	Determine the voltage (V), E, D and ρ_v at P (-4, 3, 6) if the potential $V=2x^2 y-5z$.	8	1	U
Q.4	Solve any two questions out of three.	16		
i)	Design rectangular microstrip antenna for 2.4 GHz frequency application using Rogers RT/Duroid 5880 ($\epsilon_r=2.2$) substrate with thickness of 1.6 mm. Also discuss the feeding mechanism of microstrip antennas.	8	6	Ap
ii)	State Poynting theorem. Derive mathematical expression for Poynting theorem and explain the meaning of each term.	8	2	An
iii)	Derive the transmission line impedance equation. A 50 Ω loss less transmission line is terminated by a load impedance $Z_L= 50-j75 \Omega$. If the incidence power is 100 mW, find the power dissipated by the load.	8	3	An