K. J. Somaiya Institute of Technology, Sion, Mumbai-22
(Autonomous College Affiliated to University of Mumbai)

May-June 2023-24
(B.Tech.) Program: **Electronics and Telecommunication Engineering** Scheme: IIB
Regular Examination: TY Semester: VI
Course Code: **EXC601** and Course Name: **Electromagnetics and Antenna**
Date of Exam: 22 May 2024 Duration: 2.5 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 the Coulombs Law and Biot Savart Law.	2	1	U
ii)	Explain boundary conditions of E and H fields for two media.	2	2	U
iii)	Explain transmission line with its equivalent circuit.	2	3	U
iv)	Explain isotropic antenna, omnidirectional and directional antenna.	2	4	U
v)	Justify why Circular polarization is superior for satellite application?	2	4	U
vi)	Explain single wire radiation mechanism.	2	5	U
vii)	Why micro strip antennas are also called as patch antennas?	2	6	U
viii)	Describe parabolic reflector antenna and its anyone feeding method.	2	6	U
Q.2	Solve any four questions out of six.	16		
i)	Find E, at P (1,1,1) caused by four identical 3 nC charges located at P1(1,1,0), P2 (-1,1,0), P3(-1,-1,0) and P4(1,-1,0).	4	1	Ap
ii)	Define Depth of penetration, and calculate it for a wave travelling in a conductor (σ = 3.5X107 S/m), with a frequency of 50 MHz εr = 1.2, μr = 1.	4	2	Ap

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iii)	Derive the transmission line impedance equation.	4	3	U
iv)	Explain helical antenna in normal and axial mode.	4	4	U
v)	For a uniform broadside array of 10 isotropic elements, determine the approximate directivity in dB when the spacing between the elements is $\lambda/4$, $\lambda/2$, $3\lambda/4$ and λ.	4	5	Ap
vi)	Compare Rectangular and circular Microstrip antenna.	4	6	U
Q.3	Solve any two questions out of three.	16		
i)	Three equal point charges of 4μC are located at (0, 0, 0) m, (2, 0, 0) m and (0, 2, 0) m respectively in free space. Find out net force on Q4= 5 μC at (2,2,0) m.	8	1	Ap
ii)	The normalized radiation intensity of an antenna is given by, $U = \sin\Theta * \sin\Phi$ $\quad 0 \le \Theta \le \pi, 0 \le \Phi \le \pi$ $U = 0$ elsewhere Find: (I) exact directivity (II) Azimuth and elevation plane HPBW in degrees.	8	5	An
iii)	What is line of sight propagation? Obtain expression for range of line of sight for space wave propagation in terms of antenna's transmitting and receiving heights.	8	4	An
Q.4	Solve any two questions out of three.	16		
i)	Derive Maxwell's equations in integral & Point form for time varying fields.	8	2	An
ii)	Draw the following on the smith chart. (a). 150+j75 Ω, (b). 20+j10 Ω (c). 0-j60 Ω (d). Reflection coefficient = $\Gamma = 0.2\angle 60°$. (e). constant VSWR circle for $\rho = 2.7$ (f). minimum resistance point on the constant VSWR circle for $\rho = 1.5$, if Z0=50 Ω.	8	4	Ap
iii)	Design CMSA at 5.8 GHz resonant frequency using FR4 with εr=4.4 and h=1.6 mm.	8	6	Ap