

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

<i>July-August</i> 2023-24		
(B.Tech.) Program: <b>Electronics and Telecommunication Engineering</b> Scheme: IIB		
<i>Supplementary</i> Examination: TY Semester: VI		
Course Code: <b>EXC601</b> and Course Name: <b>Electromagnetics and Antenna</b>		
Date of Exam: <i>31/07/2024</i>	Duration: 2.5 Hours	Max. Marks: 60

Instructions:		Max. Marks	CO	BT level
(1) All questions are compulsory. (2) Draw neat diagrams wherever applicable. (3) Assume suitable data, if necessary.				
Q 1	Solve any six questions out of eight:	12		
i)	Find div. D at the origin if $D = e^{-x} \sin y \hat{a}_x - e^{-x} \cos y \hat{a}_y + 2z \hat{a}_z$	2	1	Ap
ii)	State boundary conditions of E and H fields for two media at any surface of discontinuity.	2	2	U
iii)	What standing wave ratio results when $\Gamma = \pm 0.5$ ?	2	3	Ap
iv)	Sketch the radiation pattern of $\lambda/2$ Dipole and Yagi Uda antenna.	2	4, 5	Ap
v)	Define half power beam width (HPBW) and first null beam width (FNBW).	2	4	U
vi)	Compare broadside and End fire array.	2	5	U
vii)	Compare the corner and plane reflector antenna.	2	6	U
viii)	List salient features of microstrip antenna. State its advantage and disadvantage.	2	6	U
Q.2	Solve any four questions out of six.	16		
i)	Find E, at (0,0,5) m due to $Q_1 = 0.53 \mu C$ at (0,3,0) m and $Q_2 = -0.45 \mu C$ at (5,0,0) m.	4	1	Ap
ii)	Show that Electric and Magnetic Fields are perpendicular to each other in an Electromagnetic Wave?	4	2	Ap
iii)	Draw the following on the smith chart. (a). $50 + j50 \Omega$ , (b). $10 - j10 \Omega$ (c). $0 + j80 \Omega$ (d). reflection coefficient = $\Gamma = 0.3 \angle 30^\circ$ if the normalizing impedance is $50 \Omega$ .	4	3	Ap
iv)	Explain the antenna radiation regions (near field, inductive field and radiation field related to antenna).	4	4	U
v)	Explain Yagi Uda Antenna.	4	5	U
vi)	Explain the feeding methods of Microstrip antenna.	4	6	U



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Q.3	Solve any two questions out of three.	16		
i)	Determine the voltage (V), E, D and $\rho_v$ at P (-4, 3, 6) if the potential $V = 2x^2y - 5z$ .	8	1	Ap
ii)	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
iii)	Design a log periodic dipole array is to be designed to cover the frequency range 54-216 MHz and have a gain of 8.5 dB. Calculate the required element length and spacing for optimal design. Also, explain the log periodic dipole array Antenna.	8	4	An
Q.4	Solve any two questions out of three.	16		
i)	Derive boundary conditions for electrostatics and magnetostatics fields.	8	2	An
ii)	Two lossy lines are to be joined by end to end. The first line is 20 m long and has a loss rating of 0.25 dB/m. The second line is 5 m long and has a loss rating of 0.15 dB/m. The reflection coefficient at the junction (line 1 to line 2) is $\Gamma = 0.30$ . The input power to (to line 1) is 100 mW. (a) Determine the total loss of the combination in dB. (b). Determine the power transmitted to the output end of line 2.	8	4	An
iii)	Evaluate the length and width of rectangular microstrip antenna (RMSA) operating at 10 GHz resonant frequency using rogers RT/Duroid 5880 substrate ( $\epsilon_r=2.2$ ) of thickness of 1.588 mm.	8	6	An