M.E. (ETCE) 1st YEAR EXAMINATION, 2024
(1st Semester)

ANTENNA ANALYSIS AND SYNTHESIS

Time: Three hours   Full Marks 100

No. of   Marks
questions

Answer and any *five* questions.
All questions carry equal marks.
Values of physical constants may be assumed, if necessary.

1.(a)	Derive the expressions for all far field components due from a Herzian dipole and discuss their physical significances.	16
(b)	Why is it that only the radiation field components are responsible for outward power flow?	4
2.(a)	For a uniform linear array, show how does side lobe level change with number of elements?	10
(b)	Establish the existence of beam spreading as a phased array scans from broadside to end fire.	10
3.(a)	Write Schelkunov's three theorems on antenna arrays.	6
	Consider a four element end fire uniform linear array with $\lambda/4$ inter-element spacing. Demonstrate how its pattern can be improved by null shifting.	14

4.(a)   Design a 10 element linear array to produce a sectoral pattern given by
          SF(θ)=1, $\pi/4 \leq \theta \leq 3\pi/4$
                    =0, elsewhere
          using Woodward Lawson sampling technique   16
   (b)   Under what condition does the array factor become identical with radiation pattern? Cite a
          practical example.   4

5.(a)	Discuss Principle of Duality as applied to Electromagnetics.	8
(b)	Show graphically its application to the theory of images.	6
(c)	State and prove Lorenz Reciprocity Theorem in its general form.	6

6. (a)   Prove that an angle dependent geometry can be used to realize a frequency independent
          antenna.   8
   (b)   Show how a log periodic dipole array meets the above criterion and discuss its operation. 12

7. (a)   Show that the far field radiated from an aperture is the Fourier transform of field existing on
          the aperture.   12
   (b)   Use this technique to obtain the radiated far field from a uniformly illuminated rectangular
          aperture.   8

8.   Write short notes on any *two* of the followings: 10X2
          i)   Phase correction for sectoral and pyramidal horns
          ii)   Reciprocity of antenna mutual impedance
          iii)   Most general form of polarization