Ref.No: EX/PG/ETCE/T/112F/2018

M.E. (ETCE) 1st YEAR EXAMINATION, 2018
(1st Semester)

ANTENNA ANALYSIS AND SYNTHESIS

Time: Three hours

Full Marks 100

No. of questions		Marks
	Answer and any *five* questions. All questions carry equal marks. Values of physical constants may be assumed, if necessary.	
1.(a)	Explain why an antenna radiates.	6
(b)	Show that the electromagnetic fields in a source free lossless isotropic unbounded homogeneous region must be in the form of waves.	12
(c)	What is the significance of the fact that electric and magnetic fields are governed by identical differential equations.	2
2.(a)	Define polarization.	2
(b)	Elaborate different polarization schemes and their conditions of existence.	12
(c)	A short vertical transmitting antenna erected on the surface of a perfectly conducting earth produces effective field strength $E_{rms}=(E_\theta)_{rms}=100 \sin\theta$ mV/m at points of distance 1 km from the antenna (θ is the polar angle). Compute the total power radiated.	6
3.(a)	Explain how the various field components for radiation from a source are computed using retarded potential approach after establishing the approach along with necessary conditions.	16
(b)	Why is it so that only field components varying inversely with distance from the source can contribute to outward flow of power?	4
4.	For a long uniform linear array, prove that:	
(a)	The beam for broadside operation is narrower than that for end fire operation though in cases it diminishes with increase in array length.	6
(b)	But the side lobe level in either case is independent of array length.	6
(c)	Also prove that a binomial array produces no side lobes.	8
5.(a)	Determine the current distribution and the synthesized radiation pattern of a line source placed along the z-axis whose desired pattern is symmetrical about $\theta=\pi$ and is given by $SF(\theta)=1, \pi/4\leq\theta\leq3\pi/4$ 0, elsewhere Consider Woodward-Lawson synthesis for source length equal to 5λ.	10
(b)	Repeat the design for an array of 10 elements with an element spacing of $\lambda/2$.	10
6.	For a uniformly illuminated rectangular aperture in an infinite ground plane. Determine:	
(a)	The half power beam width in both E and H planes.	10
(b)	The side lobe level in both E and H planes.	10

7.	Design a four element broadside Tchebyscheff array with half wavelength spacing for side lobe level of -19.1 dB.	20
8.(a)	Prove that a self complementary antenna has impedance independent of frequency.	12
(b)	Prove that any geometry defined solely by angles can be utilized to generate frequency independent radiation characteristics.	8
9.	Write short notes on *any two* of the followings:	
(a)	Induction and Equivalence theorems	
(b)	Short circuit current at the terminals of a receiving antenna	
(c)	Reciprocity of antenna mutual impedance for transmitting and receiving modes	10 X 2