Reg. No.: 21BEC1851

Name :

VIT

Vellore Institute of Technology

(Deemed to be University under section 3 of UGC Act, 1956)

Continuous Assessment Test I – February 2024

Programme	:	B.Tech (ECE/ECM)	Semester	:	WS 2023-24
Course	:	Antenna and Microwave Engineering	Code	:	BECE305L
			Class Nbr	:	CH2023240503163
Faculty	:	Dr Richards Joe Stanislaus	Slot	:	G1+TG1
Time	:	90 Minutes	Max. Marks	:	50

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.		**a)** With fundamental relation of electromagnetic radiation, provide the condition for radiation due to charges in a thin wire of length l. **(5 marks)** Briefly discuss the following antennas with their applications: **(5 marks)** **b)** Wire antennas **c)** Aperture antennas **d)** Microstrip antennas **e)** Reflector antennas	**[10]**
2.		The power radiated by a lossy antenna is 40 watts. The conductive and dielectric losses of the antenna has the antenna efficiency as 88%. The directional characteristics of the antenna are represented by the radiation intensity of $U = B_0 \cos^2\theta$ (watts/unit solid angle) $(0 \le \theta \le \pi/2, 0 \le \phi \le 2\pi)$ **a)** Find the value of B_0. **(2 marks)** **b)** Obtain the maximum power density (watts/square meter) at a distance if 2000 m (farfield) and specify the angle where this occurs). **(2 marks)** **c)** Half power beam angles and approximate beam solid angle Ω_A. **(2 marks)** **d)** Directivity (dB) **(2 marks)** **e)** Gain (dB) **(2 marks)**	**[10]**
3.		The maximum radar cross section of a resonant linear $\lambda/2$ dipole is approximately $0.9\lambda^2$. The radar system is a monostatic system (ie transmitter and receiver at the same location). The transmitted power is 400 W, the distance of the dipole from the transmitting and receiving antennas is 200 m, the gain of the transmitting and receiving antennas is 16 dB each, and the frequency of operation is 3 GHz ($\lambda_0 = 0.1\ m$), Polarization loss factor of 1.5dB. Determine: **a)** Dimensionless Gain (linear) **(2 marks)** **b)** Received power (in pico-watts) **(6 marks)** **c)** Explain the difference between Isotropic, Directional, and Omnidirectional radiators with respect to radiated power patterns. **(2 marks)**	**[10]**

4.		a) The array factor is a function of which five features of the antenna array? **(5 marks)** A three element array of isotropic sources have identical magnitude of excitation and difference in phase excitation between the elements of $-\pi/3$. The spacing between the elements is $d = \lambda/2$. b) Find the array factor **(2 marks)** c) Find the first null angle. **(3 marks)**	**[10]**
5.		Design a broadside Dolph-Tschebyscheff array of 6 elements with spacing d between the elements and with a major-to-minor lobe ratio of 23 dB. Find the excitation coefficients and form the array factor. [Note: Use the Recursion formula for Tschebyscheff polynomial: $T_m(z) = 2zT_{m-1}(z) - T_{m-2}(z)]$	**[10]**

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