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

SCHOOL OF ELECTRONICS ENGINEERING
CONTINUOUS ASSESSMENT TEST - II
FALL SEMESTER 2024-2025

SLOT: E1 + TE1

Programme Name & Branch : B.Tech ECE & BML
Course Code and Course Name : BECE305L and Antenna and Microwave Engineering
Faculty Name(s) : Profs. SHAMBAVI K, DILIP KC, CHRISTINA JMA, YOGESH KC, KANNADASSAN D, RAJKISHOR KUMAR, RAJESHKUMAR V
Class Number(s) : 2946, 2974, 2939, 2934, 2970, 2961
Date of Examination : 17 Oct 2024
Exam Duration : 90 minutes
Maximum Marks: 50

General instruction(s): Answer All Questions

CO1: Examine the radiation mechanism of electromagnetic fields and identify the various antenna parameters.
CO2: Apply the design criteria to Linear, HF, UHF, microwave antenna and arrays.
CO6: Infer the importance of high frequency transistors to design microwave amplifiers.

Q. No	Question	M	CO	BL
1.	a) An electric field strength of 12μV/m is to be measured at an observation point θ = π/3, 250 km from a half wave dipole antenna operating in air at 60 MHz. Find (i) Length of the dipole (ii) current that must be fed to antenna.	5	1	3
	b) In an experiment, to determine the radar cross section of a Tomahawk cruise missile, a 100W, 10 GHz signal was transmitted toward the target, and the received power was measured to be –160 dB. The same antenna, whose gain was 80 (dimensionless), was used for both transmitting and receiving. The polarizations of both signals were identical (PLF = 1), and the distance between the antenna and missile was 10^4 m. What is the radar cross section of the cruise missile?	5	1	3
2.	The radiation intensity of the major lobe of an antenna is represented by U = $\cos 3\theta$. Radiation intensity is only in the upper hemisphere ($\theta = 0$ to $\frac{\pi}{2}$ and $\varphi = 0$ to 2π). Find the (i) beam area (ii) exact value of directivity in dB.	10	1	3
3.	Design a circularly polarized helical antenna with gain of 20 dB operating at 1 GHz. Calculate its (a) HPBW (b) axial ratio. Suggest the necessary changes in the number of turns are needed to achieve same gain at 2 GHz. What changes in the antenna parameters are needed to decrease its directivity to 17 dB still achieving a CP radiation.	10	2	3
4.	At low temperature, the S-parameters of a SiC BJT was measured as follow: $[S] = \begin{bmatrix} 0.80\angle -89^\circ & 0.031\angle 56^\circ \\ 2.86\angle 99^\circ & 0.75\angle -41^\circ \end{bmatrix}$ (i) Perform the K-Δ test (ii) draw the source stability circle in the Smith chart and shade the stable region.	10	6	3
5.	Design a GaN HEMT maximum gain amplifier using stubs for the output side. The transistor was biased to the active region for V_{DS} = 10 V and I_{DS} = 7.4 mA and measured S-parameters at 4.4 GHz are: $[S] = \begin{bmatrix} 0.295\angle 125.8^\circ & 0.145\angle 39.5^\circ \\ 2.81\angle 18.7^\circ & 0.401\angle -86.2^\circ \end{bmatrix}$	10	6	3

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