



VIT

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

Continuous Assessment Test II – April 2024

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

Answer ALL the questions

Q.No.	Sub. Sec.	Questions	Marks
1.		<p>A 5-element yagi-uda antenna is to be designed for hand-held anti-drone device. The design frequency is 1.5 GHz for jamming the drones' GPS signals. Obtain the following lengths in mm: (2 marks each)</p> <ol style="list-style-type: none"> Length of the reflector element. Length of the driven element Length of the three director elements Spacing between directors Obtain the estimated directivity in dBi and dBd. 	[10]
2.		<p>A highly directive pyramidal horn antenna is used as a feed of a parabolic reflector for RADAR. For an aperture length along the H plane as 12.56λ, $\delta_E = 0.20\lambda$ and $\delta_H = 0.34\lambda$, determine the following:</p> <ol style="list-style-type: none"> Length of the horn (in λ) (1 mark) E-plane aperture (in λ) (2 marks) Flare angles θ_E and θ_H (2 marks) Obtain the HPBW(E and H plane), (2 marks) FNBW (E and H plane) (2 marks) Directivity (1 mark) 	[10]
3.		<p>A Wilkinson power divider with equal split(power) is to be modelled at the design frequency of 6 GHz for 6G applications. The characteristic impedance of the microstrip lines is 60 ohms. The substrate of the microstrip line has a dielectric constant of 4.4.</p> <ol style="list-style-type: none"> Obtain the guided wavelength λ_g in mm. (2 marks) Design the Wilkinson power divider and obtain the impedances of the components of the power divider, and obtain the length (in mm) of the quarter-wavelength transformer used in the power-divider. (4 marks) For a T junction power divider with 40 ohms characteristic impedance at port 1, obtain the impedances at ports 2 and 3 for obtaining a power division of 3:1 between ports 2 and 3. (4 marks) 	[10]

4.

- a) A three port circulator has an insertion loss of 1.1dB, Isolation 36dB and VSWR 1.4. Obtain the S matrix of the three port circulator. (7 marks)
- b) A 5-dB branch line coupler has a directivity of 40 dB. If the input power $P_1 = 100$ mW, what are the power outputs at ports 2, 3. (3 marks)

[10]

The S matrix of a two port network is

$$[S] = \begin{bmatrix} 0.3\angle 0^\circ & 0.6\angle 90^\circ \\ 0.7\angle 90^\circ & 0.4\angle 0^\circ \end{bmatrix}$$

5.

- a) Is the network reciprocal? (1 marks)
- b) Is the network lossless? (2 marks)
- c) Find return loss at port 1 when port 2 is short circuited. (3 marks)
- d) A matched isolator has insertion loss 0.6dB and isolation of 30 dB. Obtain the S matrix of the isolator. (4 marks)

[10]

