

(3 Hours)

- N.B. : (1) Question number 1 is compulsory.
 (2) Attempt any three questions from remaining questions.
 (3) Figures to the right indicate full marks.
 (4) Assume suitable data wherever necessary and indicate the same.



- Q. 1 Write a short note on following. [20]
 (a) Coupled Lines
 (b) Image Frequency in Mixers
 (c) Dielectric Resonator Oscillator
 (d) Properties of S-parameters
- Q. 2 (a) Explain Hybrid and Monolithic MIC by comparing the two MICs in the following areas Cost, size and weight, Design flexibility, Circuit tweaking and Reliability. [10]
 (b) What is interference effects and frequency sharing explain. [10]
- Q. 3 (a) Write a short note on Microwave Systems Engineering. [10]
 (b) The Triquint T1G6000528 GaN HEMT has the following scattering parameters at 1.9 GHz ($Z_0 = 50 \Omega$): [10]
 $S_{11} = 0.869 \angle -159^\circ$
 $S_{12} = 0.031 \angle -9^\circ$
 $S_{21} = 4.250 \angle 61^\circ$
 $S_{22} = 0.507 \angle -117^\circ$
 Determine the stability of this transistor by using the $K - \Delta$ test and the μ -test, and plot the stability circles on a Smith chart.
- Q. 4 Design an amplifier to have a gain of 11 dB at 4.0 GHz. Plot constant-gain circle for $GS = 2$ and 3 dB, and $GL = 0$ and 1 dB. Calculate and plot the input return loss and overall amplifier gain from 3 to 5 GHz. The transistor has the following scattering parameters ($Z_0 = 50 \Omega$): [20]
- | f (GHz) | S_{11} | S_{12} | S_{21} | S_{22} |
|-----------|--------------------------|----------|------------------------|-------------------------|
| 3 | $0.80 \angle -90^\circ$ | 0 | $2.8 \angle 100^\circ$ | $0.66 \angle -50^\circ$ |
| 4 | $0.75 \angle -120^\circ$ | 0 | $2.5 \angle 80^\circ$ | $0.60 \angle -70^\circ$ |
| 5 | $0.71 \angle -140^\circ$ | 0 | $2.3 \angle 60^\circ$ | $0.58 \angle -85^\circ$ |
- Q. 5 (a) For a load impedance $Z_L = 60 - j80 \Omega$, design single-stub (short circuit) shunt tuning networks to match this load to a 50Ω line. Assuming that the load is matched at 2 GHz. [10]
 (b) How is Vector Network Analyzer used to measure periodic large signal waveform with all harmonics. [10]
- Q. 6 (a) Draw and explain in detail Single-Ended Diode Mixer. [10]
 (b) Show that the reflection coefficient is larger than 1 for a load of negative resistance. Justify your answer using I²R relation. [10]

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