(3 Hours) **Total Marks: 80**

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) Hybrid MICs versus Monolithic MICs.
(b) Noise correlation matrix.
(c) Field Surveys.
(d) Coupled Lines.

Q.2 (a) The s parameters for the HP HFET-102 FET at 2 GHZ with a bias voltage V_{gs}=0 are given as follows (Z_0=50 Ω) [10]
S_{11}= 0.894 ∠ −60.6°
S_{21}= 3.122 ∠ 123.6°
S_{12}= 0.020 ∠ 62.4°
S_{22}= 0.781 ∠ −27.6°
Determine the stability of this transistor by *K*- delta test and plot the stability circles on smith chart.

(b) Explain nonlinear measurements of microwave circuits with reference to load and source pull. [10]

Q.3 (a) Draw and explain in detail Single-Ended Diode Mixer. [10]

(b) How is Vector Network Analyzer used to measure periodic large signal waveform with all harmonics. [10]

Q.4 (a) For a load impedance Z_L = 60 − j80 Ω, design single-stub (short circuit) shunt tuning networks to match this load to a 50 Ω line. Assuming that the load is matched at 2 GHz. [10]

(b) What is phase noise in oscillators? Give a mathematical analysis of phase noise. [10]

Q.5 Design an amplifier to have a gain of 11 dB at 4.0 GHz. Plot constant-gain circle for G_S = 2 and 3 dB, and G_L = 0 and 1 dB. Calculate the input and output reflection coefficients and overall amplifier gain from 3 to 5 GHz. The transistor has the following scattering parameters (Z0 = 50 Ω): [20]

f (GHz)	S_{11}	S_{12}	S_{21}	S_{22}
3	0.80∠−90°	0	2.8∠100°	0.66∠ −50°
4	0.75 ∠−120°	0	2.5∠80°	0.60 ∠−70°
5	0.71∠ −140°	0	2.3∠60°	0.58∠−85°

Q.6 (a) Show that the reflection coefficient is larger than 1 for a load of negative resistance. Justify you answer using I2R relation. (10)

(b) Write a short note on Dielectric Resonator Oscillator [10]

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