

Time: 3 hour

Max Marks: 80

**Note: 1.Each question carries 20 marks**

**2: Question no 1 is compulsory**

**3: Solve any 3 out of remaining**

**4: Assume suitable data wherever required.**

Q1. Solve any four

20

- A What is the stability in Amplifier? Why the stability parameter  $\mu$  is required though  $\Delta$  and  $K$  are there?
- B Explain the power amplifier performance parameters
- C Explain Richard's Transformation
- D Explain working principal of Image Reject Mixer.
- E Draw one port oscillator circuit. Find value of  $R_L$  which maximizes oscillator power .

Q2 A) Design a low pass filter whose input and output are matched to a  $50 \Omega$  impedance with cut off frequency of 3 GHz, equi-ripple of 0.5 dB and rejection of at least 40 dB at approximately twice the cut-off frequency.

10

B) Design an amplifier for a power gain of 15 dB at a frequency of 3 GHz, if the selected bipolar transistor with  $V_{CE} = 4V$  and  $I_c = 5 \text{ mA}$  has following S parameters.  $S_{11} = 0.7 \angle -155^\circ$ ,  $S_{12} = 0$ ,  $S_{21} = 4 \angle 180^\circ$ ,  $S_{22} = 0.51 \angle -20^\circ$

10

Q3 A) An amplifier is having gain of 11 dB at 4 GHz. Plot constant gain circles for  $G_s = 2 \text{ dB}$  and  $3 \text{ dB}$  and  $G_L = 0 \text{ dB}$  and  $1 \text{ dB}$  using following S parameters.

10

$S_{11} = 0.75 \angle -120^\circ$ ,  $S_{12} = 0$ ,  $S_{21} = 2.5 \angle 80^\circ$ ,  $S_{22} = 0.6 \angle -70^\circ$

B) An  $N=3$  Chebyshev band pass filter is to be designed with 3 dB pass band ripple. The centre frequency is at 2.4 GHz and the filter has to meet bandwidth requirement of 20%. The filter has to be inserted into  $50 \Omega$  characteristics line impedance. Find the inductive and capacitive elements.

10

Q4 A) What is the indirect frequency synthesis? What is the effect of choice of reference frequency ( $f_r$ ) on the performance of frequency synthesizer?

10

B) Explain in detail phase noise and its effect on oscillator design.

10

Q5. A) Explain LISN in detail and how it is useful in conducting EMI tests.

10

B) What is shielding? Explain shielding effectiveness.

10

Q6. A) Explain variable modulus along with its expression.

10

B) What is ESD? Model ESD waveform and explain equivalent circuit model for ESD.

10

-----

**TABLE 8.4** Element Values for Equal-Ripple Low-Pass Filter Prototypes ( $g_0 = 1$ ,  $\omega_c = 1$ ,  $N = 1$  to 10, 0.5 dB and 3.0 dB ripple)

| 0.5 dB Ripple |        |        |        |        |        |        |        |        |        |          |          |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|
| $N$           | $g_1$  | $g_2$  | $g_3$  | $g_4$  | $g_5$  | $g_6$  | $g_7$  | $g_8$  | $g_9$  | $g_{10}$ | $g_{11}$ |
| 1             | 0.6986 | 1.0000 |        |        |        |        |        |        |        |          |          |
| 2             | 1.4029 | 0.7071 | 1.9841 |        |        |        |        |        |        |          |          |
| 3             | 1.5963 | 1.0967 | 1.5963 | 1.0000 |        |        |        |        |        |          |          |
| 4             | 1.6703 | 1.1926 | 2.3661 | 0.8419 | 1.9841 |        |        |        |        |          |          |
| 5             | 1.7058 | 1.2296 | 2.5408 | 1.2296 | 1.7058 | 1.0000 |        |        |        |          |          |
| 6             | 1.7254 | 1.2479 | 2.6064 | 1.3137 | 2.4758 | 0.8696 | 1.9841 |        |        |          |          |
| 7             | 1.7372 | 1.2583 | 2.6381 | 1.3444 | 2.6381 | 1.2583 | 1.7372 | 1.0000 |        |          |          |
| 8             | 1.7451 | 1.2647 | 2.6564 | 1.3590 | 2.6964 | 1.3389 | 2.5093 | 0.8796 | 1.9841 |          |          |
| 9             | 1.7504 | 1.2690 | 2.6678 | 1.3673 | 2.7239 | 1.3673 | 2.6678 | 1.2690 | 1.7504 | 1.0000   |          |
| 10            | 1.7543 | 1.2721 | 2.6754 | 1.3725 | 2.7392 | 1.3806 | 2.7231 | 1.3485 | 2.5239 | 0.8842   | 1.9841   |

  

| 3.0 dB Ripple |        |        |        |        |        |        |        |        |        |          |          |
|---------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----------|----------|
| $N$           | $g_1$  | $g_2$  | $g_3$  | $g_4$  | $g_5$  | $g_6$  | $g_7$  | $g_8$  | $g_9$  | $g_{10}$ | $g_{11}$ |
| 1             | 1.9953 | 1.0000 |        |        |        |        |        |        |        |          |          |
| 2             | 3.1013 | 0.5339 | 5.8095 |        |        |        |        |        |        |          |          |
| 3             | 3.3487 | 0.7117 | 3.3487 | 1.0000 |        |        |        |        |        |          |          |
| 4             | 3.4389 | 0.7483 | 4.3471 | 0.5920 | 5.8095 |        |        |        |        |          |          |
| 5             | 3.4817 | 0.7618 | 4.5381 | 0.7618 | 3.4817 | 1.0000 |        |        |        |          |          |
| 6             | 3.5045 | 0.7685 | 4.6061 | 0.7929 | 4.4641 | 0.6033 | 5.8095 |        |        |          |          |
| 7             | 3.5182 | 0.7723 | 4.6386 | 0.8039 | 4.6386 | 0.7723 | 3.5182 | 1.0000 |        |          |          |
| 8             | 3.5277 | 0.7745 | 4.6575 | 0.8089 | 4.6990 | 0.8018 | 4.4990 | 0.6073 | 5.8095 |          |          |
| 9             | 3.5340 | 0.7760 | 4.6692 | 0.8118 | 4.7272 | 0.8118 | 4.6692 | 0.7760 | 3.5340 | 1.0000   |          |
| 10            | 3.5384 | 0.7771 | 4.6768 | 0.8136 | 4.7425 | 0.8164 | 4.7260 | 0.8051 | 4.5142 | 0.6091   | 5.8095   |

Source: Reprinted from G. L. Matthaei, L. Young, and E. M. T. Jones, *Microwave Filters, Impedance-Matching Networks, and Coupling Structures*, Artech House, Dedham, Mass., 1980, with permission.