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BIELE-004

B.Tech. – VIEP – ELECTRONICS AND COMMUNICATION ENGINEERING (BTECVI)

Term-End Examination

June, 2016

00236

BIELE-004 : RF CIRCUITS

Time : 3 hours *Maximum Marks : 70*

Note : *Attempt any **seven** questions. Missing data may be suitably assumed. All questions carry equal marks.*

1. (a) Describe the RF behaviour of passive components.

(b) Explain the following :

(i) Chip Resistors

(ii) Chip Capacitors

(iii) Surface Mounted Inductors *4+6=10*

2. (a) What is a transmission line and what is its use in Microwave Engineering ? Explain various examples of transmission lines.

(b) Starting with basic definition of Standing Wave Ratio (SWR), show that it can be expressed as $SWR = \frac{1+|\Gamma_0|}{1-|\Gamma_0|}$. *5+5=10*

3. (a) Derive the expression of 'Noise Figure' for a Two-port Network and for a Cascaded Multiport Network.

(b) Discuss the noise models for active and passive components. *5+5=10*

4. For the circuit shown in Figure 1, assume a lossless line with Z_0 = 75 Ω, Z_G = 50 Ω and Z_L = 40 Ω. Compute the input power and power delivered to the load. Give you answer both in W and dBm. Assume the length of the line to be λ/2 with a source voltage of V_G = 5 V. *10*

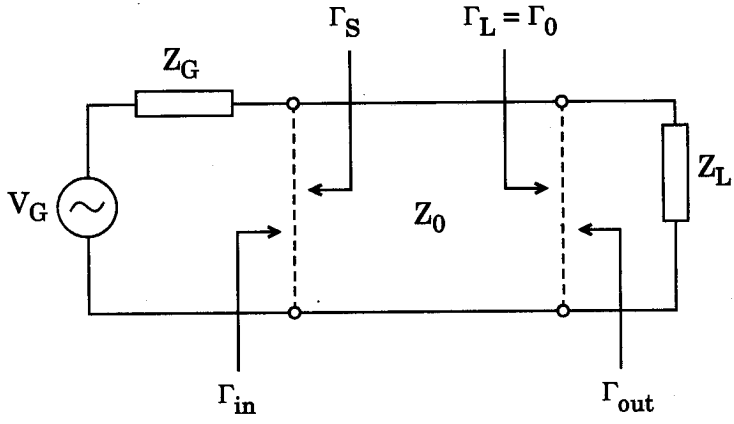

Figure 1

5. (a) Explain the characteristics of amplifiers.

(b) Explain the amplifier power relations, mentioning RF source, transducer power gain, available power gain and unilateral power gain. *5+5=10*

6. (a) Discuss the stability considerations of amplifier design.

(b) Explain large signal performance of a low noise amplifier. *5+5=10*

7. Design an 18 dB single-stage MESFET amplifier operated at 5·7 GHz. A MESFET operated at 5·7 GHz has the following S-parameters :

$S_{11} = 0{\cdot}5 \angle -60°$

$S_{12} = 0{\cdot}02 \angle 0°$

$S_{21} = 6{\cdot}5 \angle 115°$

$S_{22} = 0{\cdot}6 \angle -35°$

(a) Determine if the circuit is unconditionally stable.

(b) Find the maximum power gain under optimal choice of the reflection coefficients, assuming the unilateral design ($S_{12} = 0$).

(c) Adjust the load reflection coefficient such that the desired gain is realized using the concept of constant gain circles. *10*

8. (a) Explain the principle of basic Oscillator Model and the role of Negative Resistance Oscillator. *5*

(b) For a 200 MHz oscillation frequency, a Colpitts BJT oscillator in Common-Emitter configuration has to be designed. For the bias point of V_{CE} = 3 V and I_C = 3 mA, the following circuit parameters are given at a room temperature of 25°C :

C_{BC} = 0·1 fF, r_{BE} = 2 kΩ, r_{CE} = 10 kΩ, C_{BE} = 100 pF. If the inductance should not exceed L_3 = L = 50 nH, find the values for the capacitances in the feedback loop. *5*

9. (a) Explain the basic characteristics of mixers, by drawing its block diagram.

(b) Differentiate between single-balanced mixer and double-balanced mixer.

(c) Describe the frequency domain considerations of mixer design. *4+3+3=10*

10. Write short notes on any ***two*** of the following : *2×5=10*

(a) LNA

(b) Power Amplifiers

(c) Frequency Synthesizers