CBCS Scheme

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16/17ECS24

Second Semester M.Tech. Degree Examination, June/July 2018
RF and Microwave Circuit Design

Time: 3 hrs. Max. Marks: 80

Note: *1. Answer FIVE full questions, choosing ONE full question from each module.*
2. Use of Smith chart is permitted.

Module-1

1 a. Mention the reasons for using RF/microwaves and briefly discuss all RF/microwave applications. **(10 Marks)**

b. Analyze the LC matching N.W (show in Fig.Q1(b)) which transforms a source resistance $R_S = 100\Omega$ to a load of $R_L = 1000\Omega$. **(06 Marks)**

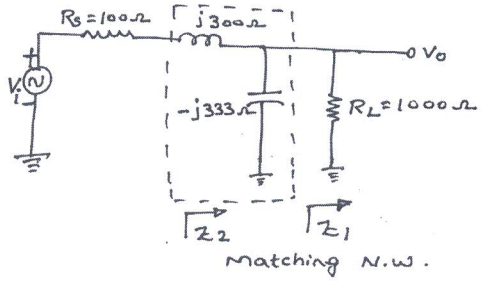

Fig.Q1(b)

OR

2 a. Explain the different S-parameters of a two-port NW. Also mention the advantages of using the S-parameters. **(10 Marks)**

b. Find the [ABCD] matrix for a shunt element [y] as shown in Fig.Q2(b). **(06 Marks)**

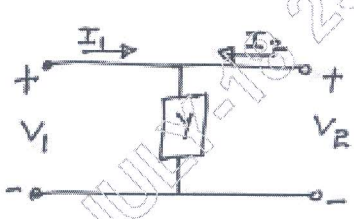

Fig.Q2(b)

Module-2

3 a. Derive the mathematical expression for the smith chart. **(08 Marks)**

b. Find the input impedance of a transmission line ($Z_0 = 50\Omega$) that has a length of $\frac{\lambda}{8}$ and is connected to a load impedance $Z_L = 50 + j50\Omega$. **(08 Marks)**

OR

4 a. Explain how smith chart can be used to plot the frequency response of RLC circuits. **(08 Marks)**

b. A microwave signal at a frequency of f = 1GHz, is travelling on a transmission line having $Z_0 = 50\Omega$ and terminated in a load of $Z_L = 20\Omega$. Find the values of Z_{max} and Z_{min} and their location on the transmission line. **(08 Marks)**

Module-3

5 a. Define stability of a system and describe the three criteria analytical method of stability analysis of RF circuits. **(07 Marks)**

b. Determine the stability of GaAs FET that has the following S–parameters at 2GHz in a 50Ω system graphically.

$S_{11} = 0.89 \angle -60°$

$S_{21} = 3.1 \angle 123°$

$S_{12} = 0.02 \angle 62°$

$S_{22} = 0.78 \angle -27°$. **(09 Marks)**

OR

6 a. For a transistor amplifier derive the expression for operating power gain (GP) and available power gain(GA). **(06 Marks)**

b. An antenna is connected to an amplifier Via a transmission line that has an attenuation of 3dB. The amplifier has the following specifications :

$G_A = 20dB$, B = 200 MHz, $T_e = 145K$.

Calculate the overall noise Fig.Q(b) and gain of the cascade at 300k. **(10 Marks)**

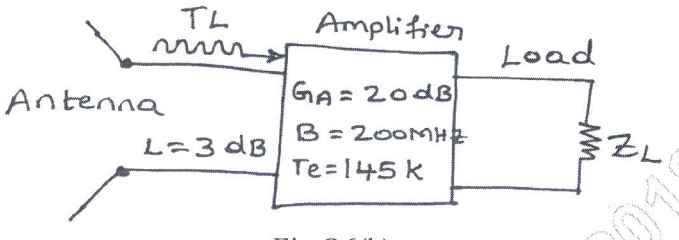

Fig.Q6(b)

Module-4

7 a. What are broad band amplifiers? Briefly describe the four design techniques of board band amplifiers. **(10 Marks)**

b. Define low noise amplifier. What are the steps involved in the design of LNA. **(06 Marks)**

OR

8 a. With a neat block diagram, explain the working and analysis of an one – diode mixer. **(08 Marks)**

b. Consider a single – ended mixer having the following port VSWR values at 10GHz $(VSWR)_{RF} = 2.0$ $(VSWR)_{IF} = 3.0$ $J_h = 3dB$. The diode used in the mixer has : $R_1 = 100\Omega$. $R_S = 2\Omega$, $C_j = 0.2pF$. What is the conversion loss of the mixer? **(08 Marks)**

Module-5

9 a. Define a phase shifter. What are the two methods of designing of digital phase shifter. **(08 Marks)**

b. Write short note on PIN diode attenuator. **(08 Marks)**

OR

10 a. What are the features and properties of an ideal substrate, dielectric, conductor or resistive material? **(09 Marks)**

b. Compare hybrid and monolithic MICS. **(07 Marks)**

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