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14ECS22

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

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

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1 a. Explain the properties, reasons for using and applications of RF/microwaves. **(08 Marks)**

b. Define the following and explain their behavior at radio frequencies:
(i) Wire (ii) Capacitor (iii) Inductor. **(06 Marks)**

c. Use the absorption method to match the source $(100 + j126\Omega)$ to a load $(100011\text{-}j795.8\Omega)$ at 100 MHz as shown in Fig. Q1 (c). **(06 Marks)**

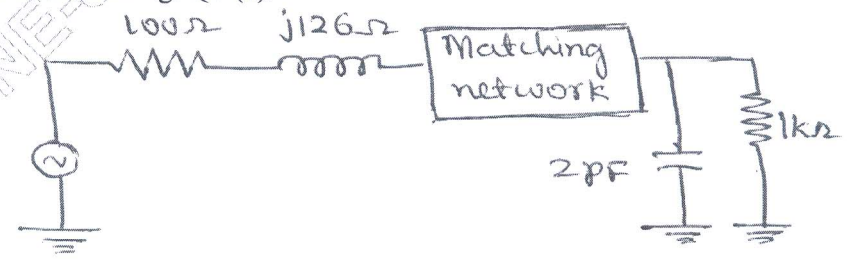

Fig. Q1 (c)

2 a. Define and derive the expressions for the following:
(i) Reflection co-efficient.
(ii) Standing wave ratio. **(08 Marks)**

b. Consider a 50 Ω lossless transmission line of length l = 1 m, connected to a generator operating at f = 1 GHz and having $V_g = 10$ V with $Z_g = 50\ \Omega$ at one end and connected to a load $Z_L = 100\ \Omega$ at the other. Determine
(i) The voltage and current at any point on the transmission line.
(ii) The voltage at the generator (V_i) and load (V_L) ends.
(iii) The reflection co-efficient and VSWR at any point on the line.
(iv) The average power delivered to the load. **(06 Marks)**

c. What are scattering parameters? Define and also explain formation of S-parameters for two port network. **(06 Marks)**

3 a. A microwave signal at frequency of f = 1 GHz is traveling 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)**

b. Given the circuit shown in Fig. Q3 (b) below, design a lumped matching network at 1 GHz that would transform $Z_L = 10 + j10\ \Omega$ into a 50 Ω transmission line. **(12 Marks)**

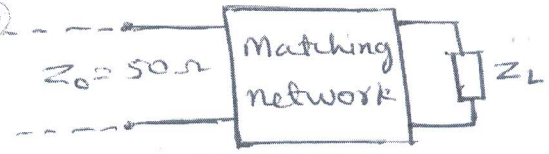

Fig. Q3 (b)

4 a. Explain the graphical solution of stability criteria. **(08 Marks)**

b. For a single stage microwave transistor amplifier define the following:

(i) Transducer power gain.

(ii) Operating power gain.

(iii) Available power gain. **(06 Marks)**

c. Define noise figure. Obtain the noise figure of a lossy network. Show that the noise figure (F) of a lossy network at room temperature equals to the attenuation factor (L). **(06 Marks)**

5 a. Explain the design of,

(i) Maximum – Gain Amplifier (MGA)

(ii) Low Noise Amplifier. (LNA) **(10 Marks)**

b. Explain the design procedure for microwave transistor oscillator. **(10 Marks)**

6 a. Design and briefly explain the following conversion loss for SSB mixers:

(i) Diode loss (ii) Mismatch loss (iii) Hormonic loss **(10 Marks)**

b. What are the two types of semiconductor phase shifters? Briefly explain any one type. **(10 Marks)**

7 a. Briefly explain MIC materials. **(10 Marks)**

b. Compare Hybrid microwave integrated circuits (HMICs) and microwave monolithic integrated circuits (MMICs). **(10 Marks)**

8 Write short notes on:

a. Smith chart.

b. One diode mixer.

c. Detector losses.

d. Chip mathematics. **(20 Marks)**

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