QPC: RJ20MTECH067 AR 19 Reg. No

GIET UNIVERSITY, GUNUPUR – 765022

M. Tech (First Semester – Regular) Examinations, June – 2021

MPEEC1042 – RF and Microwave Circuit Design

(E.C.E)

Time: 2 hrs Maximum: 50 Marks

The figures in the right hand margin indicate marks.

PART – A **(2 x 10 = 20 Marks)**

Q1. Answer **ALL** questions

a. Draw the circuit model of two wire parallel transmission line with all the parameters.

b. A transmission line has a characteristic impedance of 50+j0.01Ω and is terminated in a load impedance of 73-j42.5Ω. Calculate (a) reflection coefficient (b) the VSWR.

c. Describe the characteristics of the smith chart?

d. Why S-parameters are popularly used in microwave frequencies?

e. A 1 W power source is connected to the input of a directional coupler with C=20dB, directivity (D) is 25dB and an insertion loss of 0.7dB. Find the output powers in dBm at the through coupled and isolated ports. [Assume all ports to be matched]

f. Define critical coupling technique in resonator circuit.

g. Define power added efficiency.

h. Define gain compression for a nonlinear component.

i. Define third order intercept point for a nonlinear component.

j. An RF input signal at 1800 MHz is down-converted in a mixer to an IF frequency of 87 MHz. What are the two possible LO frequencies?

PART – B **(6 x 5 = 30 Marks)**

Answer ***ANY FIVE*** questions **Marks**

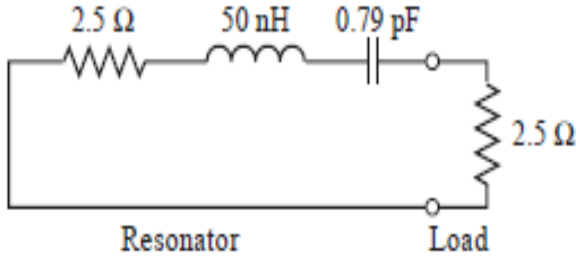
2. Derive the expression for input impedance of a terminated transmission line. Find out the equation short circuited transmission line. **(6)**

3. A two-port network is known to have the following scattering matrix: **(6)**

$$[S]=\begin{bmatrix} 0.25\angle 0^o & 0.75\angle -45^o \\ 0.75\angle 45^o & 0.2\angle 0^o \end{bmatrix}$$

Determine the network is not reciprocal and lossless. If port 2 is terminated with a matched load, what is the return loss seen at port 1.

4. A series RLC resonator with an external load is shown below. Find the resonant frequency, the unloaded Q, and the loaded Q. **(6)**



5. Design a low-pass composite filter with a cutoff frequency of 2 MHz and impedance of 75Ω. Place the infinite attenuation pole at 2.05 MHz. **(6)**

6. Find the S-matrix for an ideal 3dB 90° coupler. **(6)**

7. Explain principles of operation of Gunn diode. **(6)**

8. An RF amplifier has the following parameters: $S_{11} = 0.3\angle -70^o; S_{21} = 3.5\angle 85^o; S_{12} = 0.2\angle -10^o; S_{22} = 0.4\angle -45^o$. Furthermore, the input side of the amplifier is connected to a voltage source with $V_S = 5\angle 0^o$ and source impedance Z_S = 40Ω. The output is utilized to drive an antenna which has an impedance of Z_L = 73Ω. Assuming that the S-parameters of the amplifier are measured with reference to a Z_0 = 50Ω characteristic impedance, find the following quantities: (a) transducer gain, available gain and operative gain (b) power delivered to the load, available power and incident power to the amplifier. **(6)**

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