Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(TAKE HOME)
SEMESTER II
SESSION 2019/2020

COURSE NAME	:	RF AND MICROWAVE ENGINEERING
COURSE CODE	:	BEB 40803
PROGRAMME CODE	:	BEJ
EXAMINATION DATE	:	JULY 2020
DURATION	:	3 HOURS
INSTRUCTION	:	1.ANSWER **ALL** QUESTIONS **OPEN BOOK EXAMINATION** 2. ANSWERS MUST BE HANDWRITTEN. 3. MERGE ALL ANSWER SHEETS IN **ONE (1) FILE** AND SUBMIT IN ***PDF*** FORMAT.

THIS QUESTION PAPER CONSISTS OF **SIX (6)** PAGES

Q1 A transmission line is a distributed parameter network, where voltages and currents can vary in magnitude and phase over its length. Refer to a loaded transmission line in **Figure Q1,**

(a) ~~C~~calculate the reflection coefficient of the load

(3 marks)

(b) ~~C~~calculate the voltage standing wave ratio (VSWR) of the load

(3 marks)

(c) ~~D~~determine the value of V_{min} and V_{max}.

(5 marks)

Q2 (a) Show that the S parameter for the circuit in **Figure Q2** is

$$\begin{bmatrix} \frac{Z}{2Z_0+Z} & \frac{2Z_0}{2Z_0+Z} \\ \frac{2Z_0}{2Z_0+Z} & \frac{Z}{2Z_0+Z} \end{bmatrix}$$

(10 marks)

Q3 Doppler radar can be used for the detection of moving objects and estimating their velocities.

(a) Draw the schematic diagram of a simple doppler radar using only the components listed in **Table 2.**

(6 marks)

(b) In simple explanation, what is the function of attenuator in this system?

(3 marks)

(c) The system requires an attenuator that need to function at attenuation level of 3dB. Design the attenuator using T-configuration that will match with the 50 Ω system.

(5 marks)

Q4 A microstrip low-pass filter with cut-off frequency of 2 GHz and 30 dB attenuation at 3.5 GHz is to be designed. The filter has Chebyshev response characteristic with 0.5 dB ripple. The filter is to be implemented on a microstrip board with a relative permittivity, $\varepsilon_r = 9.9$, thickness, $h = 0.63$ mm and loss tangent, Tan $\delta = 0.001$.

~~(i)~~ (a) Sketch the frequency response with complete labelling.

(5 marks)

~~(ii)~~(b) Design the lumped element circuit prototype of the filter. Show your step by step work clearly by referring to **Figure Q3** and **Table 1**.

(10 marks)

- END OF QUESTION –

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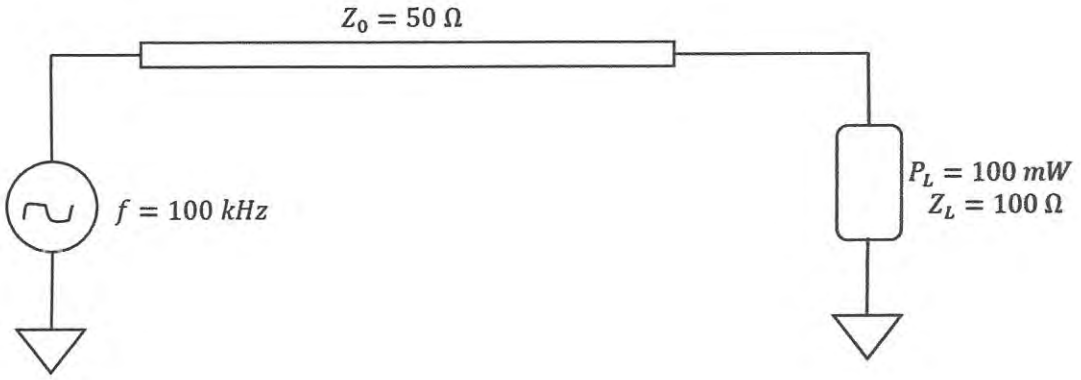

Figure Q1

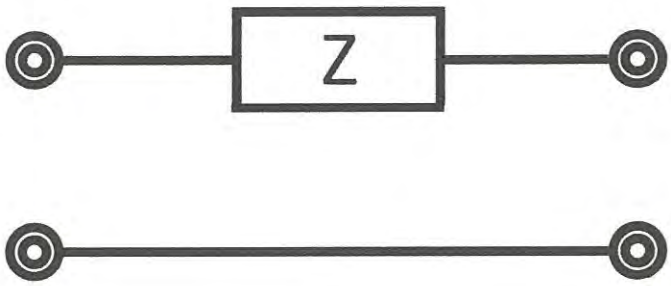

Figure Q2

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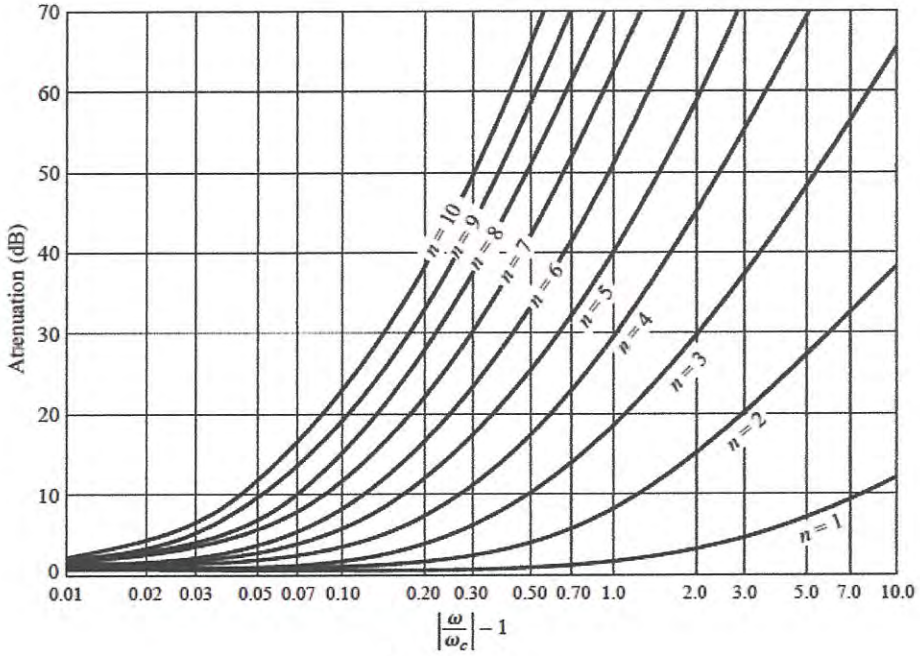

Figure Q3

TABLE 1

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

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TABLE 2

Item	Quantity
Voltage Control Oscillator	1
Base band signal generator	1
Low Noise Amplifier	1
Power Amplifier	1
Splitter	1
Mixer	1
Attenuator	1
Reflector antenna	2