FACULTY OF INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

DEGREE PROGRAMME IN ELECTRONIC'S (MASTER'S)

Course Name: Radio Engineering 1
Homework #2

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Fall 2025

Homework-2

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Q1. $Z_L = 140 - 75j\ \Omega$.

$Z_0 = 50\ \Omega$.

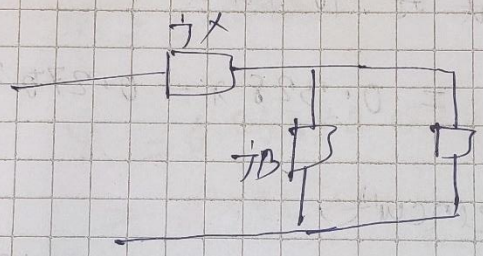
$f = 2.45\ GHz$.

So, Normalized value,

$$Z_L' = \frac{Z_L}{Z_0} = 2.8 - j1.5$$

Since, $R_L > Z_0$.

So,



Now, we move from point A to point B on the admitance to add capacitance.

$$jB = j(0.48 - 0.16) = 0.32j$$

In order to add inductor in series of load, then we need to move from point B to the corner of the circle.

$$jX = 1.60j$$

Now, calculating the components,

$$C = \frac{B}{2\pi f_0 Z} = \frac{0.32}{2\pi f_0 \times 50} = 0.415\ pF.$$

$$L = \frac{Z}{2\pi f} = \frac{50 \times 1.60}{2\pi f} = 5.10\ nH.$$

(b) · With the help of point A we ~~draw~~ USRW circle.

→ To find the intersect with 1+jx circle (point B), then travel clockwise on the USRW circle.

Now, To compensate imaginary part of point B, we find point on USRW circle which is mirrored or the origin for point B. (Point)

Now, the length of microstrip line for d_1 is:-

this will be the circumference from point A to point B.

$\therefore d_1 = 0.328\lambda - 0.275\lambda = 0.053\lambda$.

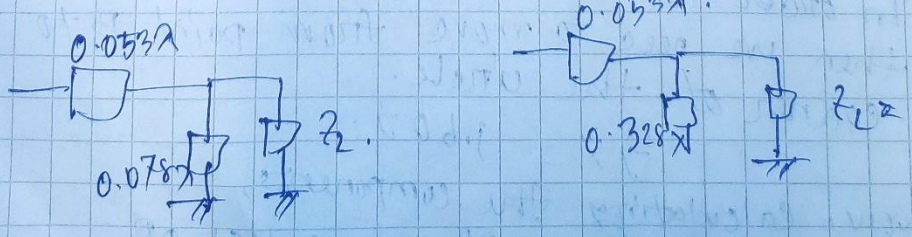
For open circuit:

$d_2 = 0.25 + 0.078\lambda$

$= 0.328$.

For short ckt,

$d_3 = 0.078$.



(c) Lumped & Microstrip line component :-

Here, we can keep the value of shunt capacitance from part (a), we calculated.

Here, Imaginary part of admittance in point is compensated by connecting stub in series. So, we move from Z_α/Z_0 clockwise to minus of point B [E = -B] for compensation and find length of microstrip required :-

[Z_0 to point E]

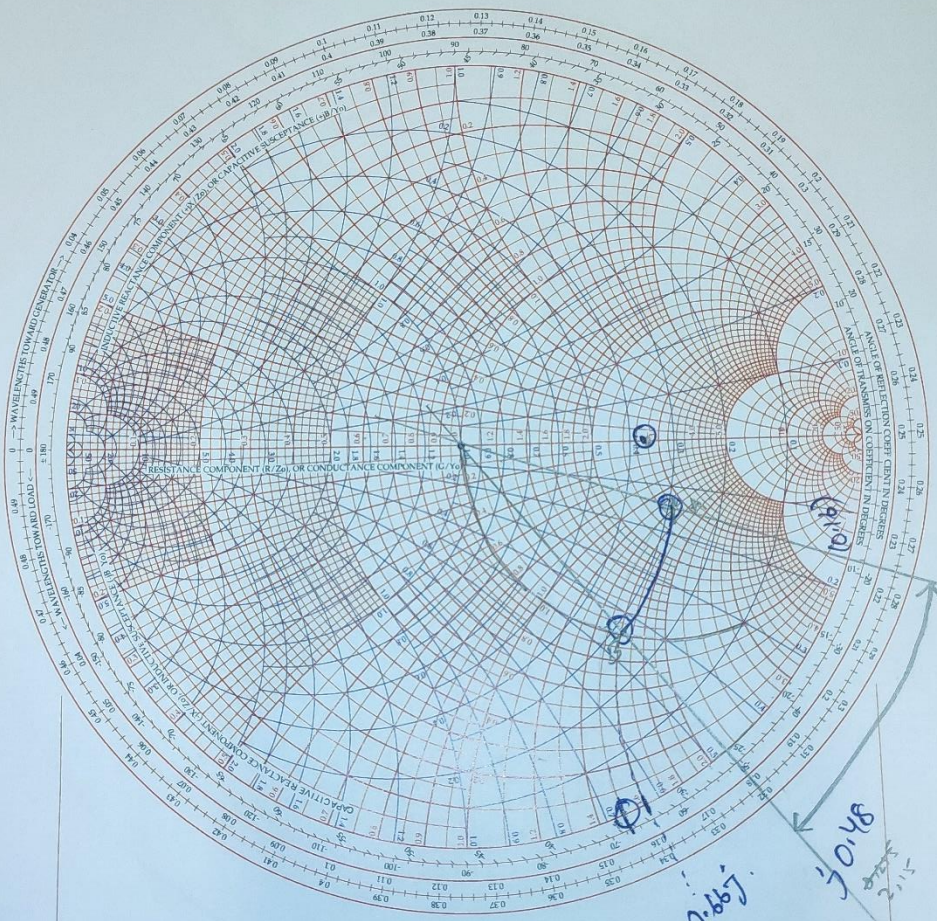
Short circuit : $Y = 0.072\lambda$.

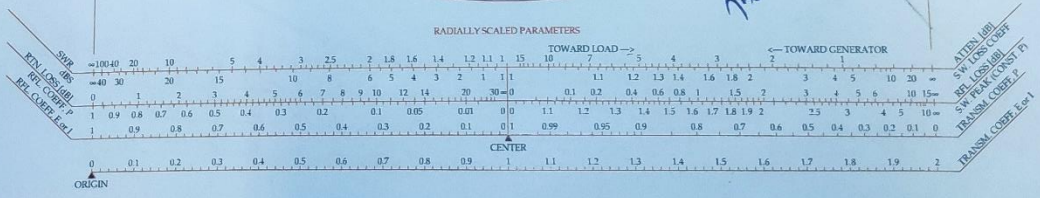
Open circuit : $Y = 0.25\lambda + 0.072\lambda$. [$Z_\alpha$ to Point E].

$= 0.322\lambda$.

NAME Arafat Miah	TITLE Radio Engineering I	DWG. NO. 01
SMITH CHART FORM ZY-01-N	Microwave Circuit Design - EE523 - Fall 1999	DATE

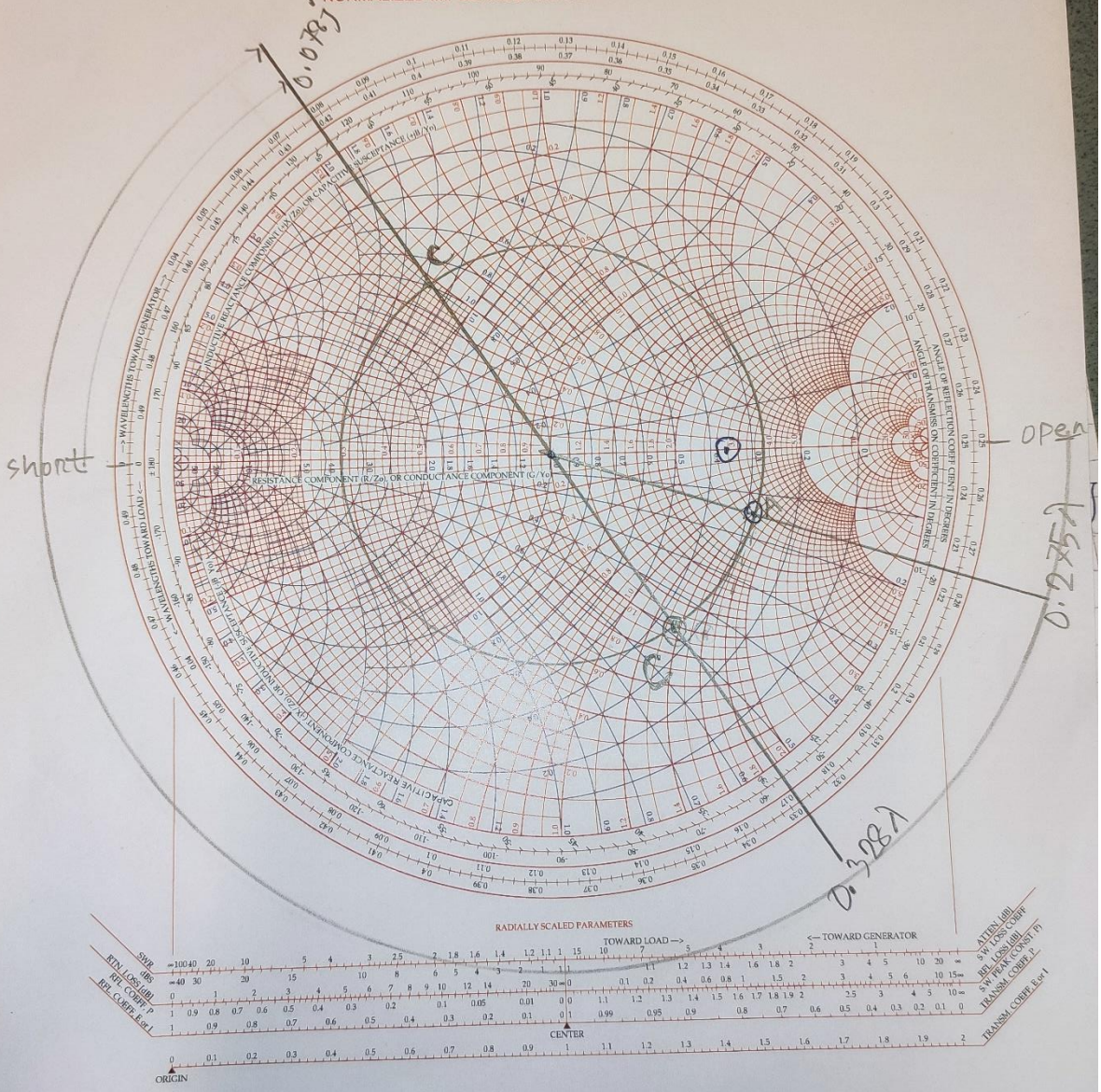
NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES





NAME Arafat Miah	TITLE Radio Engineering I.	DWG. NO 02
SMITH CHART FORM ZY-01-N	Microwave Circuit Design - EE523 - Fall 1999	DATE

NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES



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NORMALIZED IMPEDANCE AND ADMITTANCE COORDINATES

0.072λ

short

open

RESISTANCE COMPONENT (R/Zo) OR CONDUCTANCE COMPONENT (G/Yo)

RADIALLY SCALED PARAMETERS

TOWARD LOAD —>

<— TOWARD GENERATOR

ORIGIN

CENTER