12

*University of Choice*)

# MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

**MAIN CAMPUS**

**SUPPLIMENTARY/SPECIAL EXAMINATIONS**

**2021/2022 ACADEMIC YEAR**

**FIFTH YEAR FIRST SEMESTER EXAMINATIONS**

**FOR THE DEGREE OF**

**BACHELOR OF SCIENCE IN ELECTRICAL AND COMMUNICATIONS ENGINEERING**

**COURSE CODE:** ECE 514

**COURSE TITLE:** TRANSMISSION LINES

**DATE:** Thursday, 6th October, 2022 **TIME:** 3-5pm

**INSTRUCTIONS TO CANDIDATES**

ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS.

QUESTION ONE CARRIES 30 MARKS AND .LL OTHERS 20 MARKS EACH.

## SECTION A

**Question one**

a) Write the need for inductance loading of telephone cables. (3mks)
b) What is the significance of reflection coefficient? (5mks)
c) Explain what you understand by incident wave and reflected wave in transmission lines. (4mks)
d) Define wavelength of the line. (2mks)
e) State the condition for a distortionless line. (4mks)
f) When does a finite line appear as an infinite line? (4mks)
g) A 50-Ω lossless line terminated in a purely resistive load has a voltage standing-wave ratio of 3. Find all possible values of $Z_L$. (8mks)

## SECTION B

**Question two**

a) List any four types of transmission lines. (4mks)
b) Compute the VSWR of a 75 Ω transmission line when it is terminated by a load impedance of 50+j30 Ω. (4mks)
b) A 50 Ω coaxial cable feeds a 75 + j20 Ω dipole antenna. Find reflection coefficient and standing wave ratio. (4mks)
h) A coaxial line has the following characteristics at 4MHz: R = 110 Ω/Km, L = 0.255 mH/Km, G = 0.003 S/Km, C = 0.07 μF/Km.
   i) Calculate $Z_0$, α, β, υ, and λ.
   ii) With $V_o^+ = 20\angle 0$ V and $V_o^- = 0$, calculate V, I, and P at z = 4m. (8mks)

**Question three**

a) For the line of zero dissipation, what will be the values of attenuation constant and characteristic impedance? (4mks)
b) What is the application of the quarter wave matching section? (4mks)
c) A line having characteristic impedance of 50 Ω is terminated in load impedance (75 +j75) Ω. Determine the reflection coefficient. (4mks)
d) A 50-W lossless transmission line is terminated in a load with impedance $Z_L$ = (30− *j*50) Ω. The wavelength is 8 cm. Find:
   i) The reflection coefficient at the load,
   ii) The standing-wave ratio on the line,
   iii) The position of the voltage maximum nearest the load,
   iv) The position of the current maximum nearest the load. (8mks)

**Question four**

a) Calculate the load reflection coefficient of an open and short circuited line. (4mks)

b) What is frequency distortion? (2mks)

c) A lossless 50 Ω line terminated in ZL = 100 + j75 Ω is shown in figure 4B below. The line is 0.18$\lambda$ long. Calculate the input impedance if L-C circuit shown is inserted at a point 0.12$\lambda$ from the load end. (6mks)

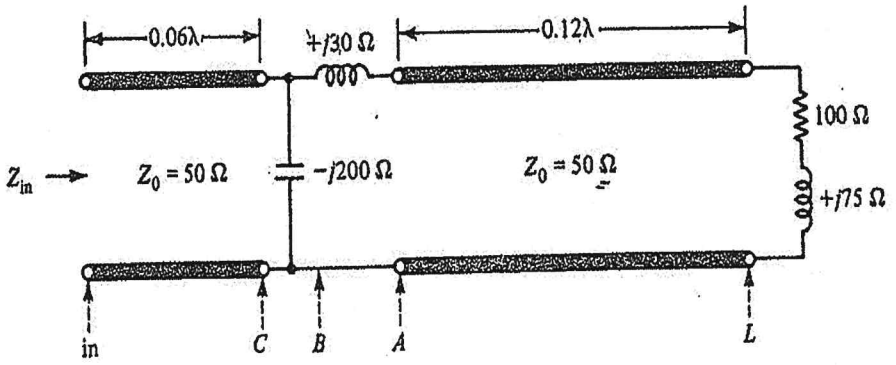



Figure 4C

d) A lossless transmission line of electrical length $l = 0.35\lambda$ is terminated in a load impedance as shown in Figure 4D. Find G, $S$, and $Z_{in}$. (8mks)

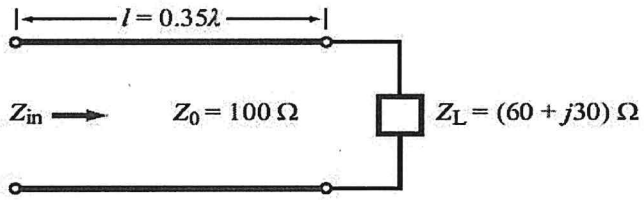



Figure 4D

**Question five**

a) Explain impendence matching using stub. (3mks)

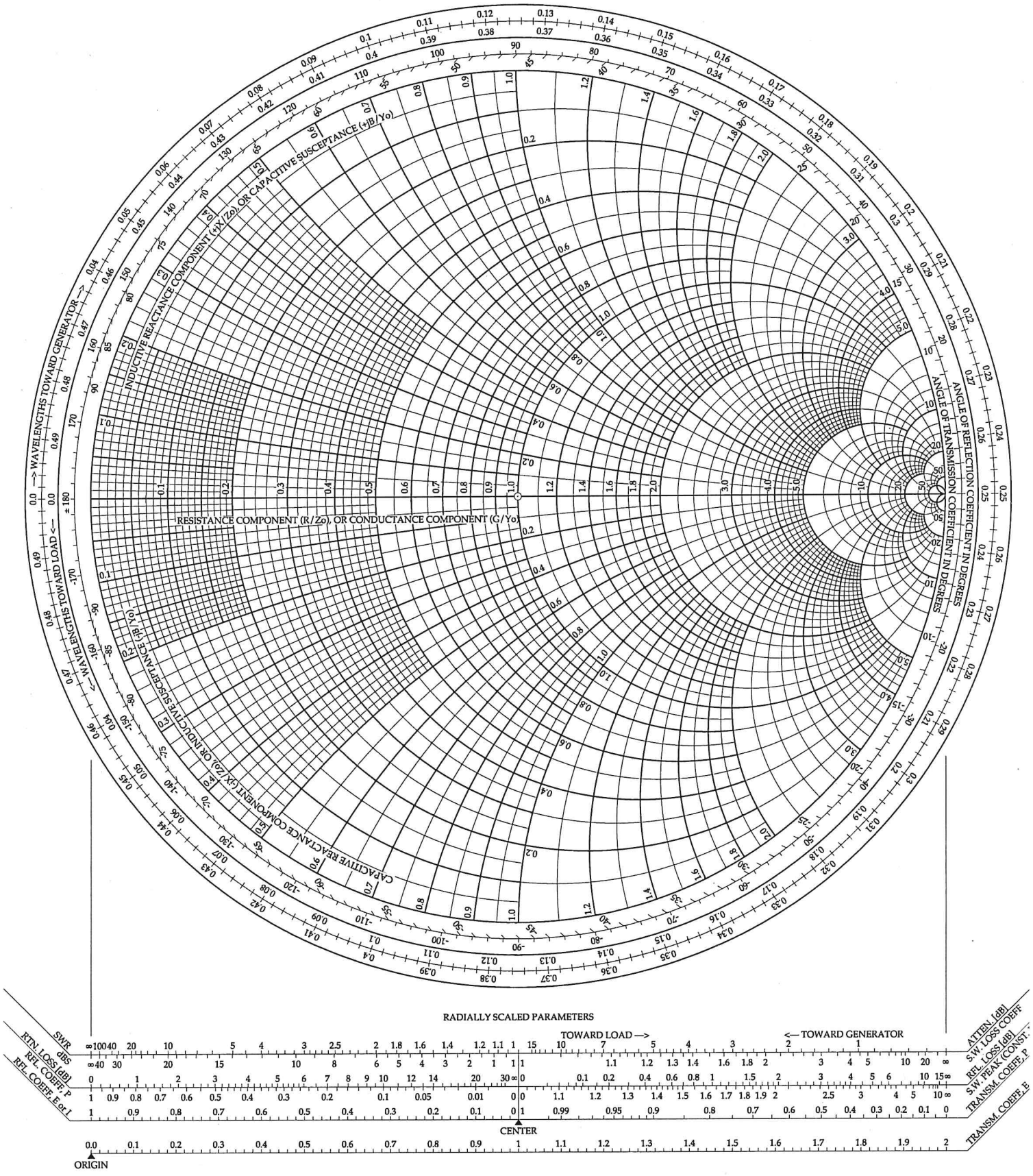
b) List the applications of the smith chart. (3mks)

c) What are the difficulties in single stub matching? (6mks)

d) For a load impedance $Z_L = 20 - j15$ Ohms, design two single-stub shunt tuning networks to match this load to 50 Ohms line using a smith chart. (8mks)

# The Complete Smith Chart

## Black Magic Design



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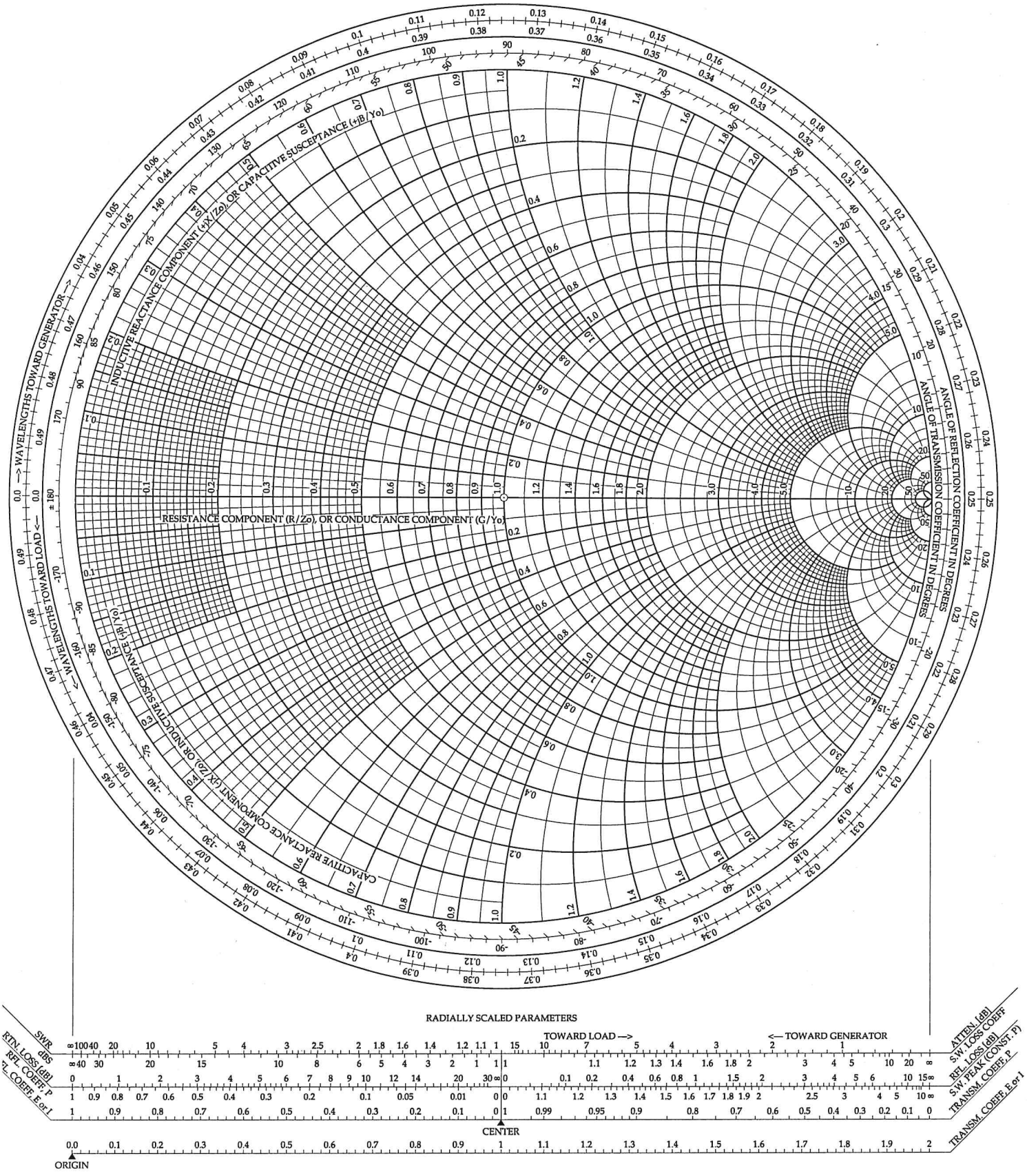

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Black Magic Design