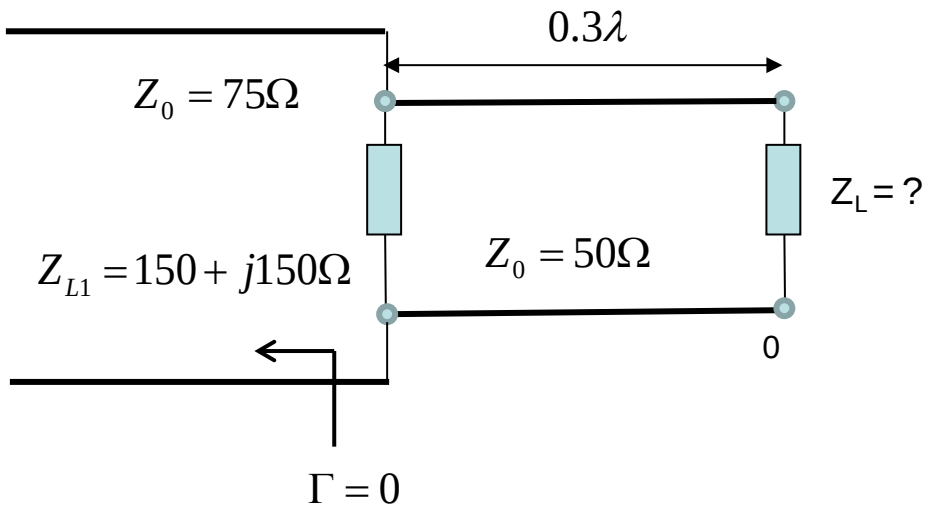
EE Problem 8

Solve the following problem using Smith chart

A 50-Ω lossless transmission line of length 0.3 λ is terminated with an unknown load impedance. The input end of the 50-Ω line is attached to the load end of a 75-Ω lossless transmission line with another load $Z_{L1} = 150 + j150\Omega$. Find out the unknown load impedance on the 50-Ω lossless transmission line that can make the reflection coefficient Γ of the 75-Ω lossless transmission line is aero, i.e. $\Gamma = 0$.



Solution:

(1) The load impedance $Z_{L1} = 150 + j150\Omega$ on the 75-Ω line is located at point Z_{L1} on Smith chart. The normalized admittance of the load is $y_{L1} = 0.23 - j0.24$.

(2) Since the total normalized admittance $y_{total} = y_{L1} + y_L$ needs to be 1 to make the reflection $\Gamma = 0$, the normalized admittance corresponding to Z_L is therefore $y_L = 0.77 + j0.24$.

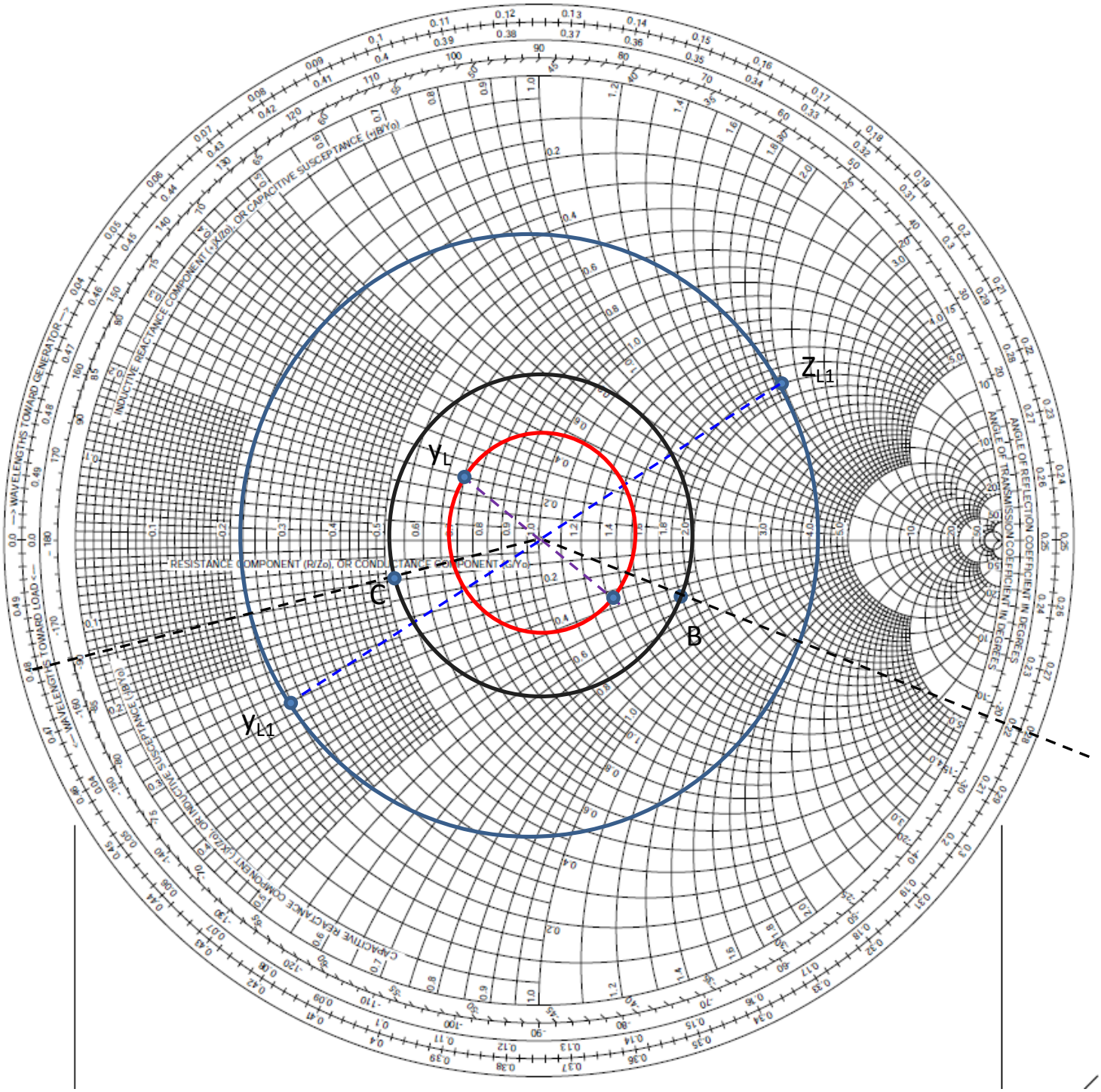
(3) The normalized impedance is $z_L = 1.35 - j0.35$

(4) The impedance is $Z_L = 101 - j26\Omega$. This corresponds to the input impedance of the 50-Ω line.

(5) The normalized input impedance is $z_{in} = 2 - j0.5$, which is point B on Smith chart.

(6) The normalized load impedance of the 50-Ω line $z_L = 0.5 - j0.1$, point C on Smith chart

(7) The load impedance on the 50-Ω line is therefore $Z_L = 25 - j5\ \Omega$.


z_{L1}
y_L
C
B
y_{L1}
RESISTANCE COMPONENT (R/Zo), OR CONDUCTANCE COMPONENT (G/Yo)
INDUCTIVE REACTANCE COMPONENT (+jX/Zo), OR CAPACITIVE SUSCEPTANCE (+jB/Yo)
CAPACTIVE REACTANCE COMPONENT (-jX/Zo), OR INDUCTIVE SUSCEPTANCE (-jB/Yo)
ANGLE OF REFLECTION COEFFICIENT IN DEGREES
ANGLE OF TRANSMISSION COEFFICIENT IN DEGREES
—> WAVELENGTHS TOWARD GENERATOR —>
<— WAVELENGTHS TOWARD LOAD <—