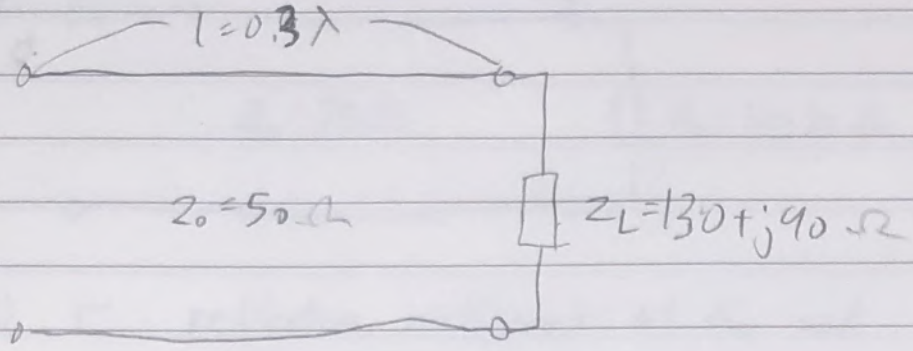
COSE 483-00
Homework 2

Date

김성준 2016320256
No.

1.




$\Gamma$ : reflection coefficient at the load

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{130+j90-50}{130+j90+50} = \frac{80+j90}{180+j90} = \frac{120.416\angle 41.63^\circ}{201.246\angle 63.43^\circ}$$

$$= 0.598\angle -21.8^\circ$$

$\Gamma(z=-l)$ : reflection coefficient at the input

$$\Gamma e^{-j2\beta l} = (0.598\angle -21.8^\circ)e^{-j216} \qquad = 0.598\angle -165.8^\circ$$

$$\beta l = \frac{2\pi}{\lambda}\cdot 0.3\lambda = 0.6\pi = 108^\circ$$

Input Impedance

$$Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan\beta l}{Z_0 + jZ_L \tan\beta l} = 50\,\frac{130+j90+j50\tan(108^\circ)}{50+j(130+j90)\tan(108^\circ)}$$

$$= 50\,\frac{130+j(-63.884)}{327+j(-400.1)}$$

$$= 50\,\frac{144.85\angle -63.83^\circ}{516\angle -79.26^\circ}$$

$$= 14.8\angle 24.57^\circ$$

$$= 12.73 + j5.82\ \Omega$$

morning glory

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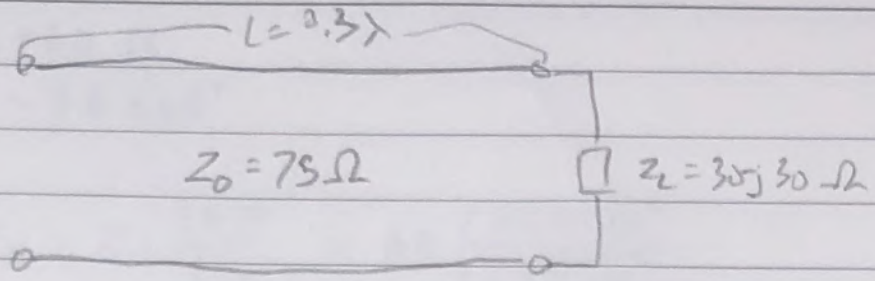
2.




a) $\Gamma$ : reflection coefficient at the load

$$\Gamma = \frac{Z_L - Z_0}{Z_L + Z_0} = \frac{30 - j30 - 75}{30 - j30 + 75} = \frac{-45 - j30}{105 - j30}$$

$$= \frac{54.083 \angle 56.31^\circ}{109.202 \angle -74.05^\circ}$$

$$= 0.495 \angle 130.36^\circ$$

$$= -0.32 + j0.38$$

b) $\Gamma(z = -\lambda)$ : reflection coefficient at the input

$$\Gamma e^{-2j\beta l} = (0.495 \angle 130.36^\circ) e^{-j4\pi}$$

$$\beta l = \frac{2\pi}{\lambda} \cdot 0.3\lambda = 0.6\pi = 108^\circ$$

$$= 0.495 \angle 274.36^\circ$$

$$= 0.04 - j0.49$$

c) Input impedance

$$Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan\beta l}{Z_0 + jZ_L \tan\beta l} = 75 \cdot \frac{30 - j30 + j75 \tan(108^\circ)}{75 + j(30 - j30)\tan(108^\circ)}$$

$$= 75 \frac{30 + j(-260.826)}{17.33 + j(-92.33)}$$

$$= 75 \frac{262.546 \angle -6.561^\circ}{93.942 \angle 10.631^\circ}$$

$$= 209.609 \angle 17.192^\circ$$

$$= 200.24 + j61.95$$

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3. $Z_0 = 60\ \Omega$

$\Gamma = 0.4 \angle 60^\circ$

a) $Z_L = Z_0 \frac{1+\Gamma}{1-\Gamma} = 60 \frac{1+0.4\angle 60^\circ}{1-0.4\angle 60^\circ}$

$= 60 \frac{1.25\angle 16.26^\circ}{0.87\angle -23.63^\circ}$

$= 86.207 \angle 39.89^\circ$

$= 66.14 + j\,55.29$

b) $\Gamma = |\Gamma| e^{j(\theta_r - \beta l)}$

$\beta l = \frac{2\pi}{\lambda} \cdot 0.3\lambda = 0.6\pi = 108^\circ$

$\Gamma = 0.4\, e^{j(60^\circ - 216^\circ)}$

$= 0.4\, e^{j(-156^\circ)}$

c) $Z_{in} = Z_0 \frac{Z_L + jZ_0 \tan\beta l}{Z_0 + jZ_L \tan\beta l} = 60 \frac{66.14 + j55.29 + j60 \tan(108^\circ)}{60 + j(66.14 + j55.27)\tan(108^\circ)}$

$= 60 \frac{66.14 + j(-129.371)}{230.165 + j(-203.558)}$

$= 60 \frac{145.30\angle -62.92^\circ}{307.27\angle -41.49^\circ}$

$= 28.372 \angle 21.43^\circ$

$= 26.41 + j\,10.37$

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Q. $z_L = \frac{Z_L}{Z_0}$

$= \frac{40 + j20}{50}$

$= 0.8 + j0.4$ — Plot Smith chart at (A)

104° from (B)

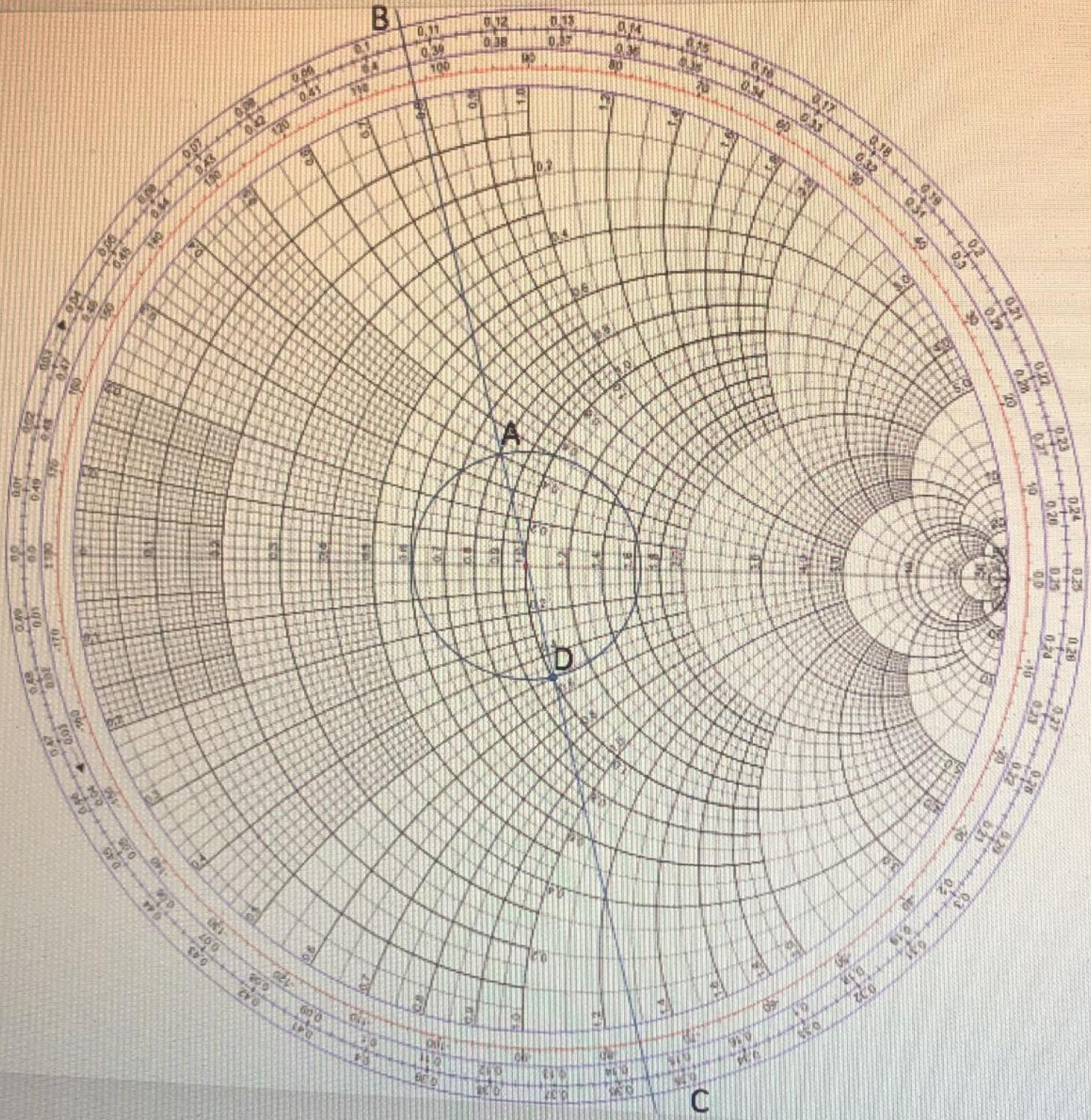
2.5m & 2π rad/m → +π just other side of circle

$2.5 \times 2\pi = 5\pi$

$104° + 5\pi = 1004° = (360° \times 3) - 76$

~~+76°~~ × from (C)

$\boxed{z_{in} = 1 - j0.5}$ from (D) input impedance at P



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5. $z_L = \frac{Z_L}{Z_0}$

$= \frac{100 - j100}{50}$

$= 2 - j2$ Plot at (A)

a) $|\Gamma| = \frac{|OA|}{|OZ|} = \frac{5.1}{8.22} = 0.62$, $\theta_r = -30°$, $\Gamma = 0.62 \angle -30°$
$= 1.54 - j0.31$

b) $-30°$ from (B)

0.05 m & $2\pi/3$ rad/m

$0.05 \times 20\pi/3 = 60°$

$-30° + 60$

$-90°$ from (C) $30°$ not sure which way

or

$z_n = 0.45 - j0.9$ from (D) $2 + j2$