NAME SOLUTION

# ECE 202

## EXAM I

## JULY 14, '06

| PROBLEM | POINTS | SCORE |
|---|---|---|
| 1 | 24 | |
| 2 | 26 | |
| 3 | 26 | |
| 4 | 24 | |
| | 100 | |

NOTE:

1) YOU MUST PLACE YOUR ANSWERS ON THE LINES PROVIDED.
2) SOME ANSWERS MAY HAVE LITTLE OR NO PARTIAL CREDIT. PLEASE CHECK YOUR WORK.
3) SOME ANSWERS MAY HAVE PARTIAL CREDIT, SO PLEASE SHOW YOUR WORK.
4) THIS EXAM HAS 4 PROBLEMS EACH ONE PAGE LONG. CHECK TO SEE YOU HAVE 4 PROBLEMS.
5) ALL ANSWERS MUST HAVE UNITS AND BE IN ENGINEERING NOTATION.

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1) ANSWER THE FOLLOWING

A) FIND THE PHASOR REPRESENTATIONS OF THE TIME DOMAIN FUNCTIONS

i) $v_1 = 47\cos(377t + 62^\circ)$ V

$\vec{V}_1 = \underline{47\angle 62^\circ \text{ V}}$ (4)

ii) $i_1 = 14\sin(2000t - 13^\circ)$ mA

$14\cos(2kt - 13^\circ - 90^\circ)$m

$\vec{I}_1 = \underline{14\text{m}\angle -103^\circ \text{ A}}$ (4)

iii) $v_2 = -881\cos(4t - 25^\circ)$ V

$881\cos(4t - 25^\circ + 180^\circ)$

$\vec{V}_2 = \underline{881\angle 155^\circ \text{ V}}$ (4)

B) IF $f = 770$Hz, FIND THE TIME DOMAIN FUNCTIONS FOR THE FOLLOWING PHASORS

i) $\vec{I}_2 = 7\mu + j\,6\mu$ A

$9.22\mu\angle 40.6^\circ$ $\quad i_2(t) = \underline{9.22\mu\cos(4.84kt + 40.6^\circ)\text{ A}}$ (4)

ii) $\vec{V}_3 = 31 - j\,21$ V

$37.4\angle -34.1^\circ$ $\quad v_3(t) = \underline{37.4\cos(4.84kt - 34.1^\circ)\text{V}}$ (4)

C) WHAT IS THE IMPEDANCE OF A 220mH INDUCTANCE IF $f = 60$ Hz ?

$j\omega L = j(377)(0.22)$

$Z = \underline{j82.94\Omega}$ (4)

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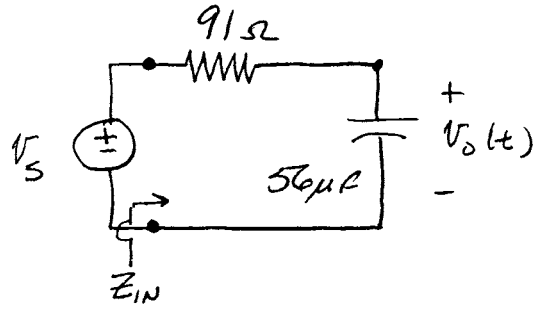
2)

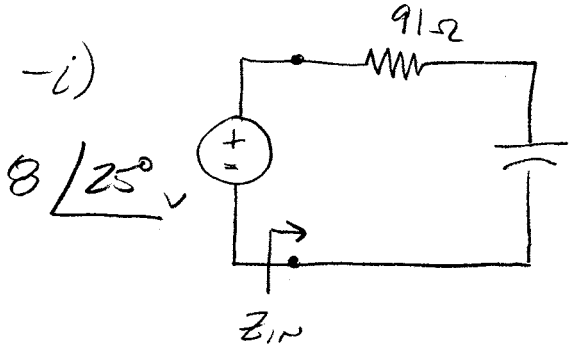



A) FIND $Z_{IN}$ IN POLAR FORM

B) FIND THE STEADY-STATE VOLTAGE $V_o(t)$

$V_s = 8\cos(377t + 25°)$ V

-i)




-ii) $Z_{IN} = 91 - j\,47.37 = 102.6\angle -27.5°$

$$\vec{V}_o = 8\angle 25° \frac{-j\,47.37}{91 - j\,47.37}$$

$$= 8\angle 25° \frac{47.37\angle -90°}{102.6\angle -27.5°}$$

$$= 3.69\angle -37.5°$$

-iii) $v_o(t) = 3.69\cos(377t - 37.5°)$

$Z_{IN} = \underline{102.6\angle -27.5°\ \Omega}$ (12)

$v_o(t) = \underline{3.69\cos(377t - 37.5°)\ V}$ (14)

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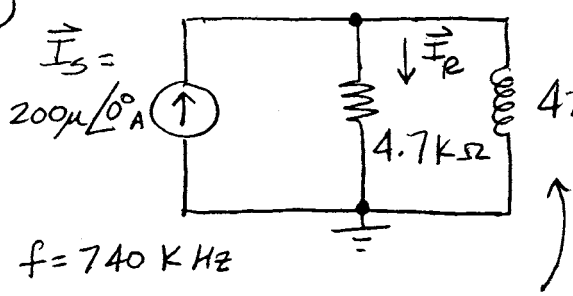
3)




GIVEN THIS FREQ. DOMAIN CIRCUIT, FIND $\vec{I}_R$, IN (RECTANGULAR FORM), BY USING THE CURRENT DIVIDER RULE.

$$\vec{I}_R = 200\mu\angle 0° \;\frac{j\,2.185K}{4.7K + j\,2.185K}$$

$$= 200\mu\angle 0° \;\frac{2.185K\angle 90°}{5.183K\angle 24.9°}$$

$$= 84.3\mu\angle 65.1°$$

$$= 35.5\mu + j\,76.46\mu$$

$$\vec{I}_R = (35.5\mu + j\,76.46\mu)\,A$$ (26)

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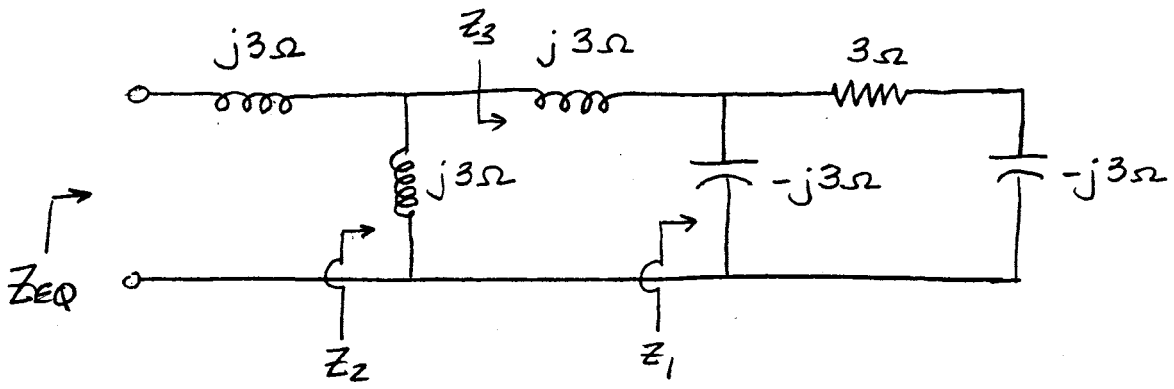
4) GIVEN THE FREQ. DOMAIN CIRCUIT, FIND $Z_1$, $Z_2$ AND $Z_{EQ}$ IN POLAR FORM




$$Z_1 = \frac{-j3(3-j3)}{-j3+3-j3} = \frac{-j9-9}{-j6+3} = \frac{12.73\angle -135^\circ}{6.71\angle -63.4}$$

$$= 1.897\angle -71.6 = 0.598 - j1.8$$

$$Z_3 = j3 + 0.598 - j1.8 = 0.598 + j1.2$$

$$Z_2 = \frac{j3(0.598+j1.2)}{j3+0.598+j1.2} = \frac{j1.794-3.6}{0.598+4.2} = \frac{4.02\angle 153.5^\circ}{4.24\angle 81.9^\circ}$$

$$= 0.948\angle 71.6^\circ = 0.3 + j0.9$$

$$Z_{EQ} = j3 + 0.3 + j0.9 = 0.3 + j3.9 = 3.91\angle 85.6^\circ$$

$Z_1 = \underline{1.897\angle -71.6^\circ\ \Omega}$ (8)

$Z_2 = \underline{948\text{m}\angle 71.6^\circ\ \Omega}$ (3)

$Z_{EQ} = \underline{3.91\angle 85.6^\circ\ \Omega}$ (3)