EET 350 Test #1(3:00 PM Section) 10/05/23

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This is an open-notes, open-book test. Each question has a corresponding box in which you should place your answer. There is ample room provided to complete the calculations for each question. Conventional calculators are allowed, however no other personal electronics may be used during the test other than those needed for accessing the uploading the test. A formula sheet is located on the last page of the test for your use. Cell phones must not be used during the taking of this test. You must show your work demonstrating how you arrived at the solution. Answers that are unsupported will be given less than full credit. Remember, proper units are required as part of your answer. **The test that you wish to have graded must be uploaded to Blackboard no later than 4:30 PM on 10/05/23. You are also required to email the instructor (iflory@odu.edu) the same document that you just uploaded to Blackboard no later than 4:30 PM on 10/05/23. Make certain that your submission is complete since the late submission of any test solutions will not be accepted for grading.** Good luck.

Please sign: I have neither given nor received information pertaining to this examination.

Signature:

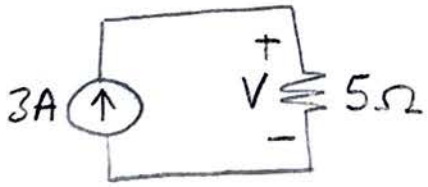
1. Determine the unknown quantities. [12 points]

a.)

$I = \frac{10V}{40\Omega} = .25\ A$

a. I = .25 A

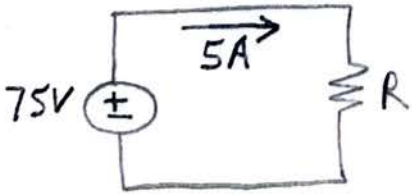
b.)



$V = 3A \cdot 5\Omega =$

b. V = 15 V

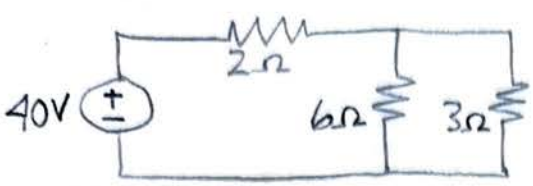
c.)



$R = \frac{75V}{5A}$

c. R = 15Ω

2. What is the total power delivered by the voltage source in the circuit below? [6 points]



$\frac{6\cdot3}{6+3} = 2\Omega$ $\quad 2+2 = 4\Omega$ $\quad I = \frac{40V}{4\Omega} = 10A$ $\quad P = VI = 40V \cdot 10A = 400W$

P = 400W

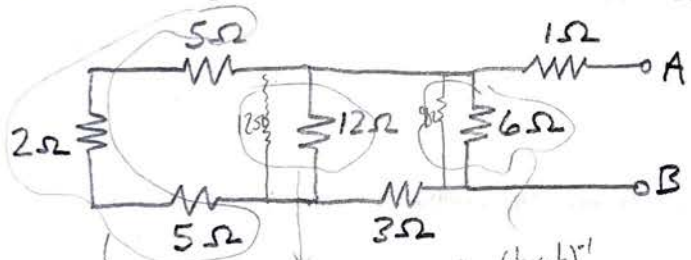
3. A resistive heating element is rated for 3A at 120V. What is the resistance of the heating element and the power absorbed (dissipated) by the heating element if the applied voltage is actually 100V? [6 points]

$R = \frac{120V}{3A} = 40\Omega$

$P = \frac{100^2}{40} = 250W$

R = 40Ω
P = 250W

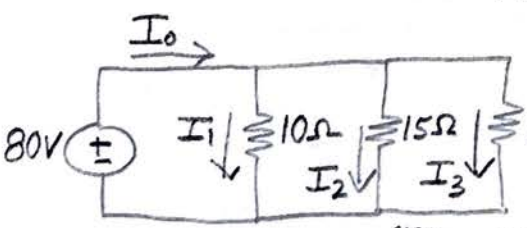
4. What is the equivalent resistance between terminals A and B? [6 points]



$5+2+5 = 12\Omega$ $\quad \frac{12}{2} = 6\Omega$ $\quad 3+6 = 9$ $\quad Req = \left(\frac{1}{9}+\frac{1}{6}\right)^{-1} = 3.6\Omega + 1\Omega = 4.6\Omega$

R_{eq} = 4.6Ω

5. Find all currents in the circuit below. [8 points]

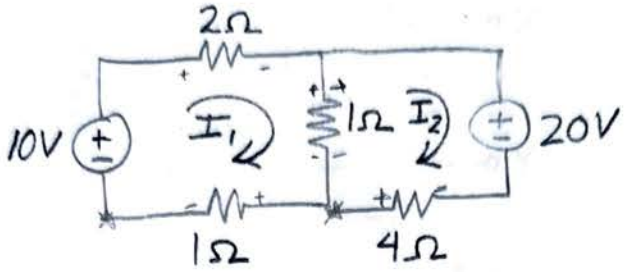


$I_1 = \frac{80V}{10\Omega} = 8A$ $\quad I_2 = \frac{80V}{15\Omega} = 5.33A$ $\quad I_3 = \frac{80V}{20\Omega} = 4A$

$I_0 = 8A + 5.33A + 4A = 17.33A$

I_1 = 8A
I_2 = 5.33A
I_3 = 4A
I_0 = 17.33A

6. Determine the mesh currents I_1 and I_2 as shown in the following circuit. (Remember, currents and voltages can be negative) [10 points]



M_1: $-10 + 2I_1 + 1(I_1 - I_2) + 1I_1 = 0$

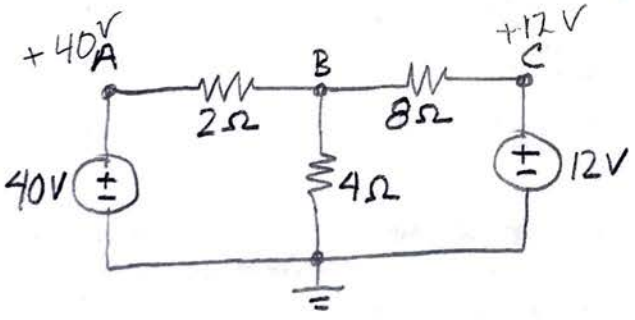
$$4I_1 - I_2 = 10$$

M_2: $-1(I_2 - I_1) + 20 - 4I_2 = 0$

$$-5I_2 + I_1 = -20$$

$I_1 = 3.68\ A$
$I_2 = 4.74\ A$

7. Solve for the voltage at node B in the circuit below using nodal analysis. [10 points]



$$\frac{V_B - 40}{2} + \frac{V_B}{4} + \frac{V_B - 12}{8} = 0$$

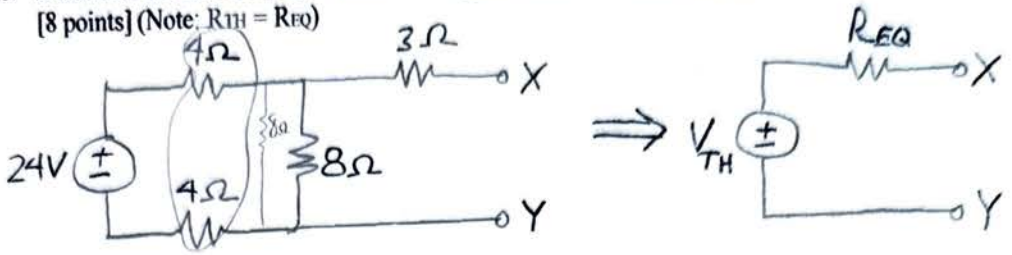
$$8 \times \left(\frac{4V_B - 160 + 2V_B + V_B - 12}{8} \right) = 0 \times 8$$

$$7V_B - 172 = 0$$

$$V_B = \frac{172}{7} = 24.57\ V$$

$V_B = 24.57V$

8. Determine the Thevenin equivalent circuit parameters (V_{TH} and R_{TH}) as seen at terminals X and Y. [8 points] (Note: $R_{TH} = R_{EQ}$)



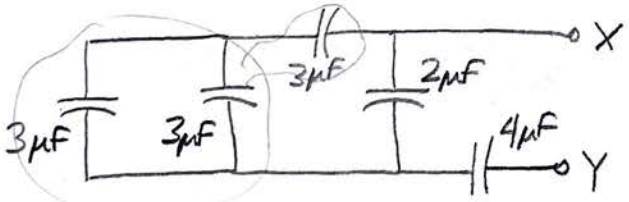
$4+4 = 8\Omega$

$\frac{8}{2} = 4\Omega + 3\Omega = 7\Omega = R_{eq}$

$\frac{8}{8+8} \cdot 24 = 12V = V_{TH}$

V_{TH} = 12V
R_{TH} = 7Ω

9. What is the equivalent capacitance across terminals X and Y in the circuit below? [5 points]



$3uF + 3uF = 6uF$

$C_{eq} = \left(\frac{1}{6} + \frac{1}{3}\right)^{-1} = 2uF + 2uF = 4uF$

$C_{eq} = \left(\frac{1}{4} + \frac{1}{4}\right)^{-1} = 2uF$

C_{EQ} = 2μF

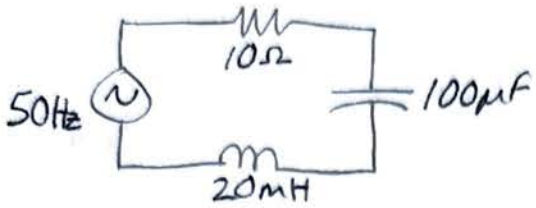
10. Given the following voltage equation, identify the following quantities - V_{pk}, ω, f, and θ. Remember units. [4 points]

$$v(t) = 170\sin(200t - 27°)\ \text{V}$$

V_{pk} = 170	ω = 200	f = 31.831Hz	θ = -27°

$\frac{200}{2\pi} = 31.83$

11. What is the equivalent series impedance as seen by the source in the circuit below? Leave your answer in polar form. [10 points]



$Z_R = 10\Omega \angle 0^\circ = 10 + j0$

$Z_L = 50 \cdot 2\pi \cdot .02 \angle 90^\circ = 6.283\Omega \angle 90^\circ = 0 + j6.283$

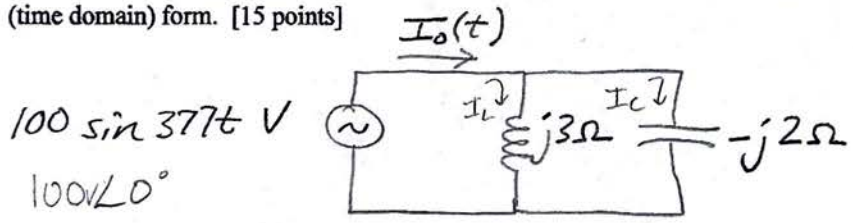
$Z_C = \frac{1}{5 \cdot 2\pi \cdot 100 \times 10^{-6}} \angle -90^\circ = 31.83 \angle -90^\circ = 0 - j31.83$

$Z_{TOT} = 10 - j25.548 = \sqrt{10^2 + (25.548)^2} \angle \tan^{-1}\left(\frac{25.548}{10}\right)$

$= 27.435\Omega \angle -68.623^\circ$

$Z_{EQ} = 27.4\Omega \angle 68.6^\circ$

12. Given the following circuit, determine the source current I_o? Present your answer in instantaneous (time domain) form. [15 points]



$I_L = \frac{100V\angle 0^\circ}{3\angle 90^\circ} = 33.33\angle -90^\circ A$

$I_C = \frac{100V\angle 0^\circ}{2\angle -90^\circ} = 50\angle 90^\circ A$

$I_o = -j33.33 + j50$

$= 0 + j16.666 = \sqrt{0^2 + (16.666)^2} \angle \tan^{-1}\left(\frac{16.666}{0}\right) = 16.66\angle 90^\circ$

$I_o(t) = 16.66 \sin(377t + 90^\circ)$

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