PASS MOCK EXAM – FOR PRACTICE ONLY

Course: ELEC 2501

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Mock exam reviews will take place:

Thurs, Dec.8	**2-5pm**	**AP 132**
Sat, Dec. 10	**2-4pm**	**ME 3275**

Note that in each session we will review the same mock examination. Content of each session will be very similar. Also note that the Saturday workshop is an hour shorter, so there will be less time for questions in order to get through the exam. If there is time after the review, I will answer questions.

Important:

To get the most benefit from this mock exam please complete this mock exam under **exam conditions**:

- Complete in 3 hours
- Use only what is allowed in your actual final: pen/pencil, eraser, calculator and ruler
- Work on your own without your notes or the textbook
- Attempt every question

After the time is up, put the exam aside for a bit and take a break. Later on, with a different colour or on a separate piece of paper, go back over the exam and try to answer the questions you couldn't answer or were unsure of before. This time if you need to, you can use your notes as needed.

Doing the mock exam this way will help you to gauge how well you would perform on an exam if you had to write the exam today. This will help you to identify the areas that you need more studying and practice in. As I'm sure many of you discovered with the quizzes, you might think you understand a concept completely when you can "peek" at your notes. However, when you can't use these other resources, it becomes a lot more difficult.

Please note:

- Come to the mock exam review with the exam completed, that way you gain the most benefit from the review.
- I will not provide a printout of the mock exam at the review session. It is expected that you have attempted the mock as outlined above and will bring your own printout along with any rough work you did for each question.
- There will be no answer key provided for the mock exam. Instead, there are 2 sessions in which the examination will be reviewed. See above for session times and dates.
- All the questions on this mock exam are taken from **previous final exams**.

Good luck!

Q1. RMS Value and Power (17 marks)

a) For the periodic waveform in Figure 1:

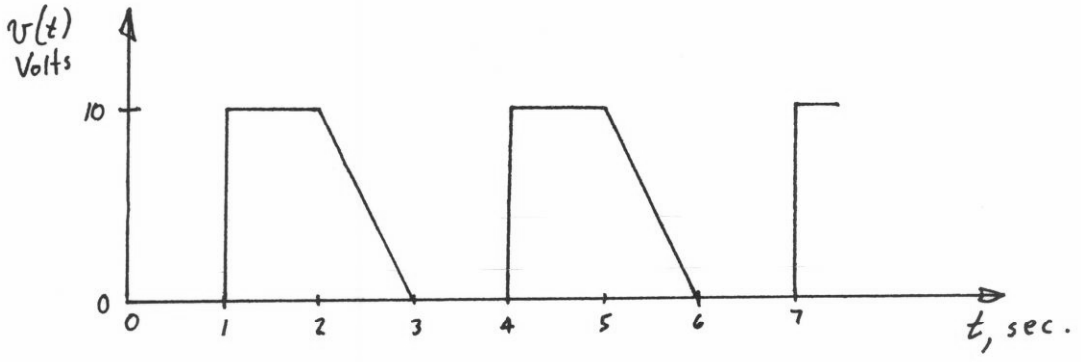


Figure 1.

ai) What are representative equations for the non-zero parts of the waveform?

Answer: v(t) = _____

_____ marks /3:__

aii) Using the equations above, what is the equation for calculating the RMS value of the waveform?

Answer: RMS = _____ marks /3:__

aiii) What is the RMS value of the waveform?

Answer: RMS = _____ marks /2:__

1b) In the following circuit, find the power that is absorbed or supplied by each of the three listed elements:

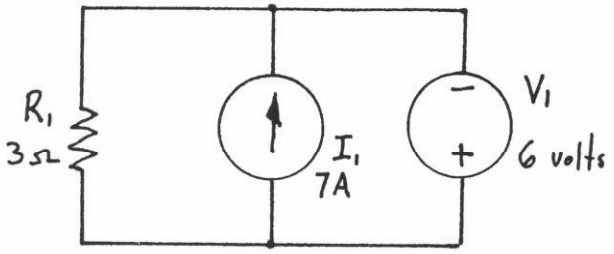


Figure 2.

Answer: Power in R_1: _____watts

Power in I_1: _____watts

Power in V_1: _____watts marks/4:____

1c) Given the circuit of Figure 3:

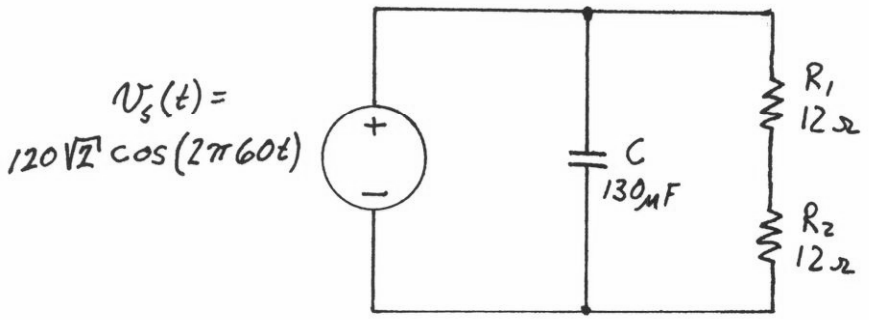


Figure 3.

What is the average power dissipated in each of R_1 and C?

Answer: Average power in R_1 is_____watts marks/3: __

Average power in C is_____watts marks/2: __

Q2. Thevenin, Norton and Superposition (21 marks)

a) For the circuit shown in Figure 4, find the **Thevenin** equivalent source between the terminals A and B.

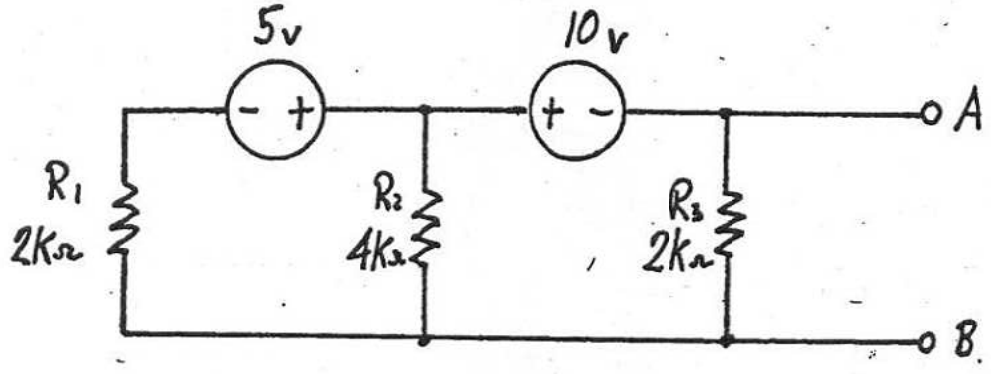


Figure 4.

Answer: Thevenin equivalent source:

marks/7:___

b) For the circuit shown in Figure 5, find the **Norton** equivalent source between the terminals A and B.

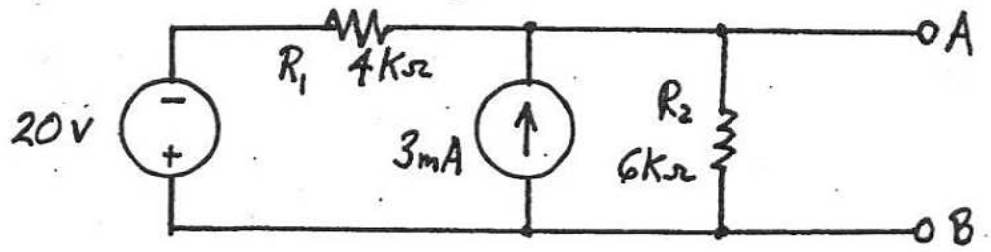


Figure 5.

Answer: Norton equivalent source:

marks/7:

2c) For the circuit shown in Figure 6:

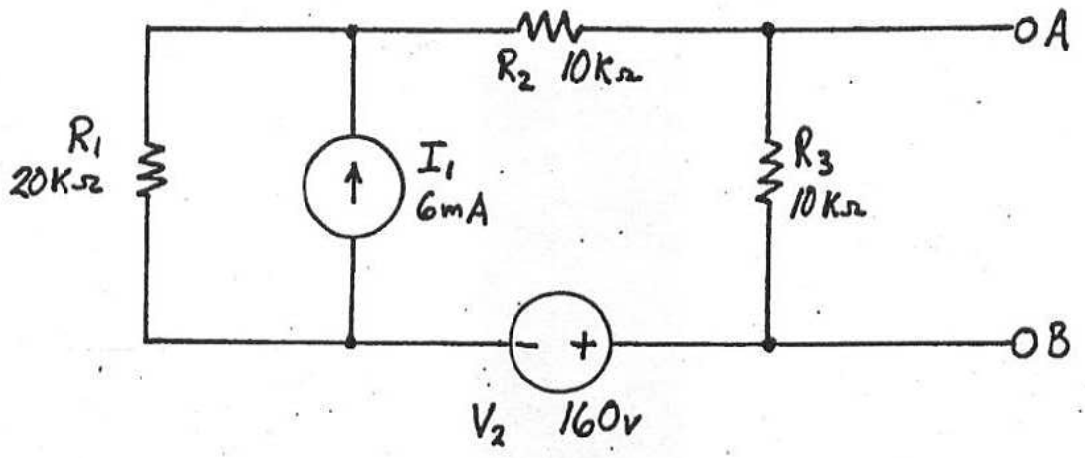


Figure 6.

Use superposition to find the contribution of each source to the output voltage V_{AB}, and then find the total output voltage V_{AB}.

Answer: Contribution to V_{AB} made by the source I_1: _____ marks/3: ___

Contribution to V_{AB} made by the source V_2: _____ marks/3: ___

Total V_{AB} using superposition theorem: _____ marks/1: ___

Q3. **Nodal Analysis and Loop Analysis** (12 marks)

a) Given the circuit in figure 7, write the nodal equations for nodes V_1, V_2 and V_3 using the convention that currents entering a node are positive. (No need to simplify.)

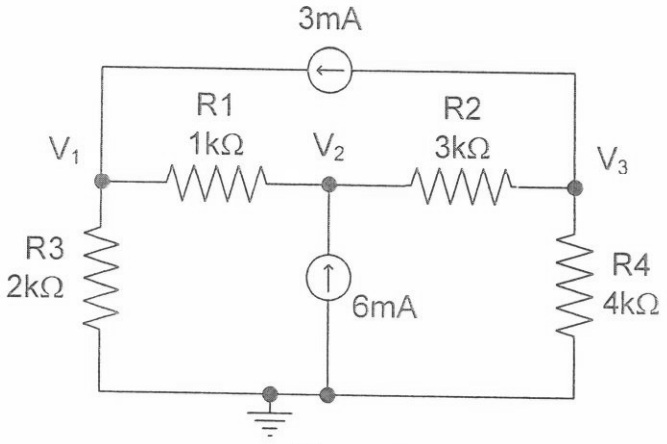


Figure 7.

Answer:

Node V_1 _____ Marks/2:____

Node V_2 _____ Marks/2:____

Node V_3 _____ Marks/2:____

b) Given the circuit in figure 8, write the loop equations for the two loops. (No need to simplify.)

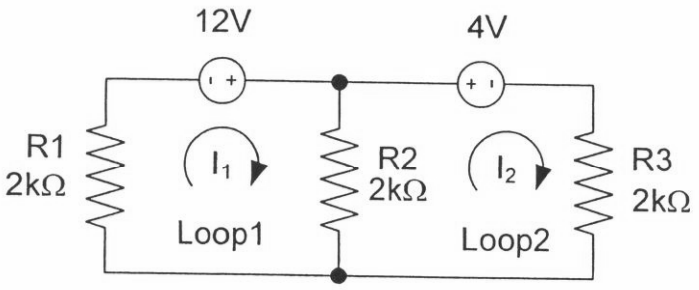


Figure 8

Answer:

Around Loop 1 _____ Marks/3:____

Around Loop 2 _____ Marks/3:____

Q4. Phasor Analysis **(19 marks)**

Note: Answers may be in either polar or Cartesian form, but still must be simplified, e.g. 15 ∠30° volts, or e.g. 30-j27 ohms.

a) For the circuit given in Figure 9:

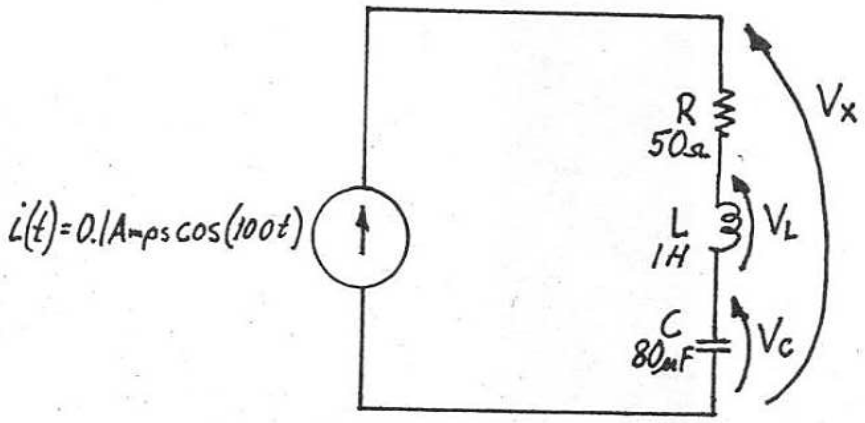


Figure 9.

a i) Find the impedance of the inductor and the impedance of the capacitor.

Answer: Z_L = _____ marks /1: ___

Answer: Z_C = _____ marks /2: ___

a ii) Find the inductor and capacitor voltages as phasors.

Answer: V_L = _____ marks /2: ___

Answer: V_C = _____ marks /2: ___

a iii) Find the voltage V_x as a phasor.

Answer: V_x = _____ marks /2: ___

b) Given the KCL equation $I_X = I_1 + I_2$ in which $I_1 = 20 \angle +30°$ amps and $I_2 = 50 \angle -90°$ amps:

b i) Calculate I_X as a phasor:

Answer: $I_X =$ _____ amps marks /2: ___

b ii) For $I_X = I_1 + I_2$, show KCL is satisfied in a clear phasor diagram, approximately to scale:

Answer: Phasor diagram showing KCL:

marks/3: ___

c) A series RLC resonant circuit is to have a resonant frequency of 1 MHz and is to use L = 0.1 mH.

ci) What value of C is required?

Answer: C = _____ marks /2: ___

cii) If the circuit is to have a bandwidth (BW) of 12 kHz, what is the value of Q?

Answer: Q = _____ marks /2: ___

ciii) At resonance, what is the combined impedance of the inductor plus capacitor?

Answer: Z = _____ marks /1: ___

Q5. Frequency Response and Bode Plots (11 marks)

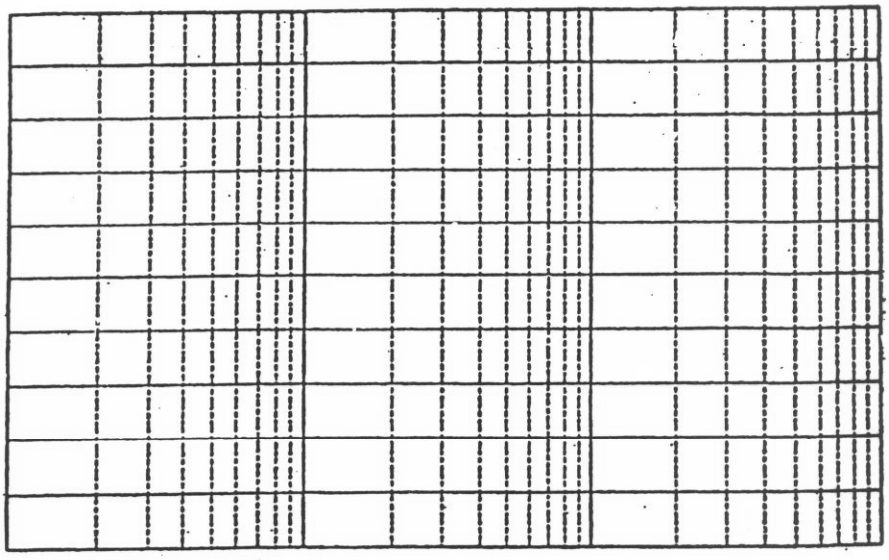
Given the transfer function $H(j\omega) = V_{OUT} / V_{IN} = 200 / (1000+j\omega)$:

a) What is the value of the corner frequency in radians per second?

Answer: The corner frequency is _____ marks/2: ___

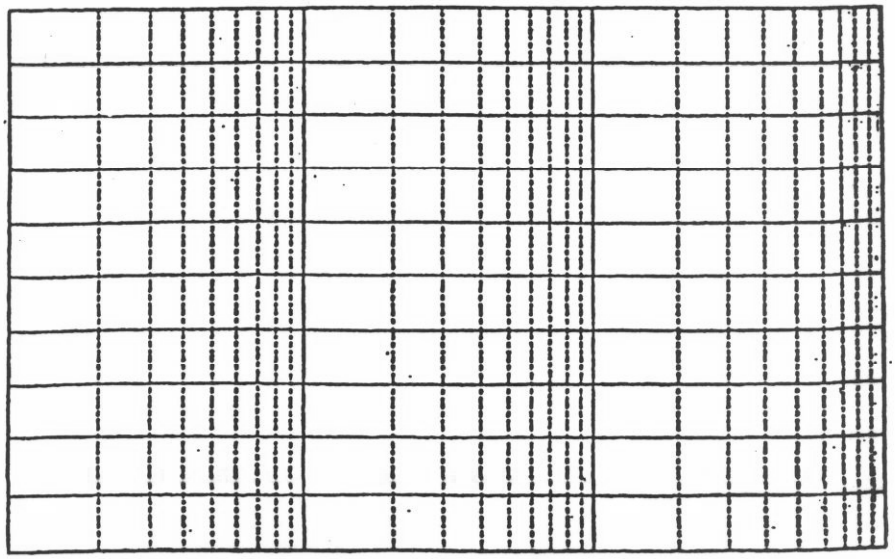
b) Draw the magnitude and phase Bode plots, clearly indicating the ***important values*** on each of them.

Answer: Magnitude Bode Plot:



marks/5: ___

Answer: Phase Bode plot:



marks/4: ___

Q6. Transient Analysis **(22 marks)**

a) In the circuit of Figure 10, switch S is open for all $t < 0$. At $t = 0$ the switch is closed.

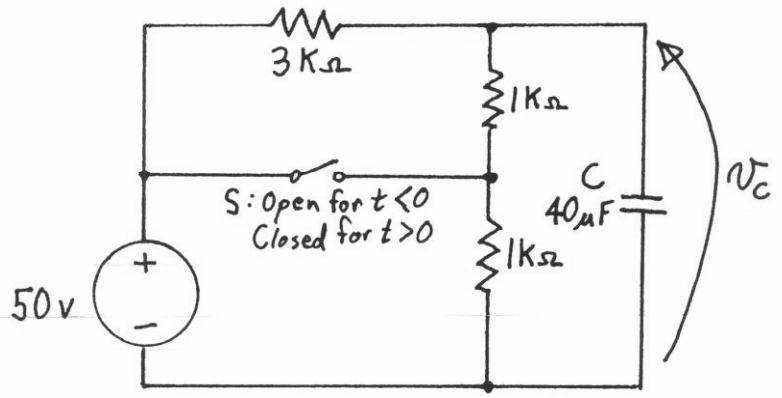


Figure 10.

a i) Find the voltage across the capacitor, v_C, for $t < 0$.

Answer: For $t < 0$, v_C = _____ marks /1:___

a ii) Derive an expression for the voltage across the capacitor, $v_C(t)$, for $t > 0$.

Answer: For $t > 0$, $v_C(t)$ = _____ marks /8:___

a iii) Sketch $v_C(t)$ from t = -10 msec. to t = +100 msec. clearly showing the time constant and its relationship to the waveform.

Answer: Graph of $v_C(t)$:

marks/3:___

a iv) If the response above is interrupted at t = +40 msec. by the switch being opened, derive a new equation for $v_C(t)$ for t > +40 msec.

Answer: For t > +40 msec., $v_C(t)$=_____ marks /5:___

b) In the circuit shown below in Figure 11, switch S is closed for all t < 0. At t = 0 the switch is opened.

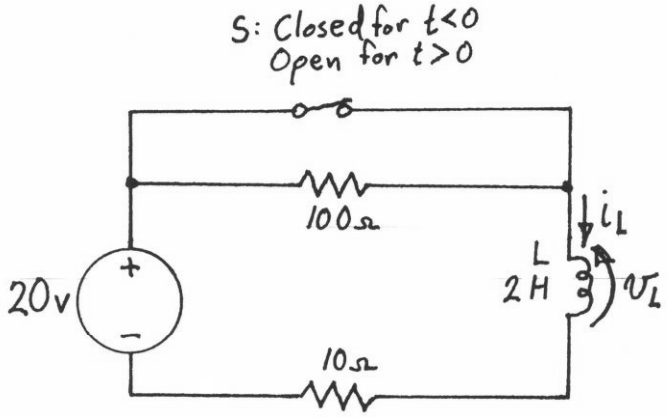


Figure 11.

b i) Find the inductor current, i_L, just before the switch is opened.

Answer: i_L = _____ marks /1:___

b ii) Find v_L at the instant just after the switch is opened.

Answer: v_L = _____ marks /3: ___

b iii) Find the time constant for the response of v_L for t > 0.

Answer: Time Constant = _____ marks /1: ___

Happy Holidays!