SIST; ShanghaiTech

Final exam; Spring semester; 2019-2020 academic year

EE111 Electric Circuits

7 Problems (2 A4 crib sheet allowed)
Answer the Questions in English
Show your work (for partial credits)
8:00-10:00, June 29, 2020

PRINT your name: (last name)_____, (first name)_____

PRINT your email ID: _____@shanghaitech.edu.cn

PRINT your student ID:_____

School:_____

INSTRUCTIONS:

- You have 120 minutes (8:00-10:00) to complete the exam.
- Your exam will not be graded unless you complete the above section and the cover sheet, and turn in both this exam book and the cover sheet.
- Mark your answers on the exam itself. We will not grade answers written on scratch paper.

STOP! Do not turn this page until the instructor tells you to do so.

Important: Verify that your exam book has 9 pages. In addition, you have 4 pages of scratch papers; please remove them from this book for your own usage.

Do NOT write in this section.

Problem	1	2	3	4	5	6	7	8	Total
Max									100
Points									

Signature of Examiner:
Date:

Signature of Reviewer:
Date:

1. **(10 points)** Use superposition theorem to find the voltage *U*.

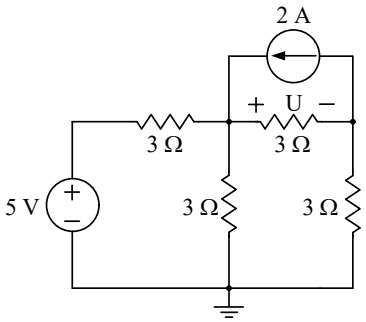

Figure of Problem 1

Solution of Problem 1:

2. **(15 points)** For the circuit shown in following figure,

(1) Find and draw the Thevenin equivalent circuit of the left hand side part of the circuit seen from the port *a* and *b*;

(2) The switch has been at position **1** for a long time. Then it is turned to position **2** at t = 0. Find $i\ (t)$ for t > 0.

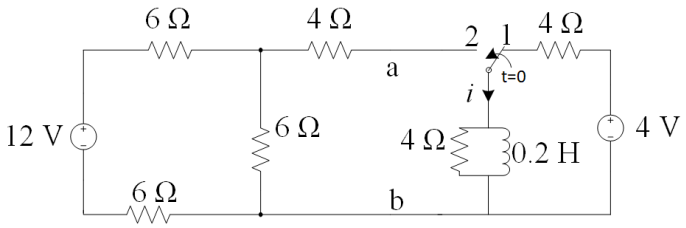

Figure of Problem 2

Solution of Problem 2:

3. **(15 points)** Given $R_1=4\,\Omega$, $R_2=10\,\Omega$, C_1=0.25F, C_2=0.5F, L_1=2H, L_2=4H, M=0.5H. Assume the circuit is in steady state. Find $i_x(t)$.

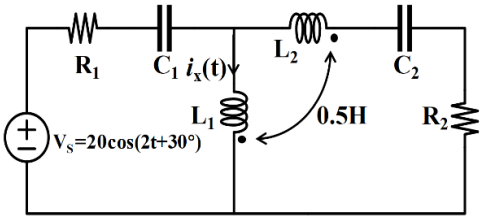

Figure of Problem 3

Solution of Problem 3:

4. **(15 points)** For the circuit shown in following figure, assume the circuit is in steady state.

(1) Write the transfer function $H(\omega) = \frac{V_o}{V_i}$;

(2) Plot the Bode plots (including magnitude Bode plots and phase Bode plots) of $H(\omega)$, with proper notations on the Bode plots (such as cutoff frequencies, slope of the curves, etc.)

(3) Specify what type of filter it is.

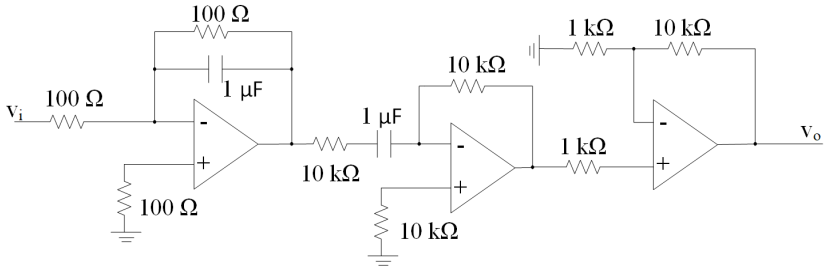

Figure of Problem 4

Solution of Problem 4:

5. **(15 points)** Refer to the balanced three-phase Y-△ circuit below.

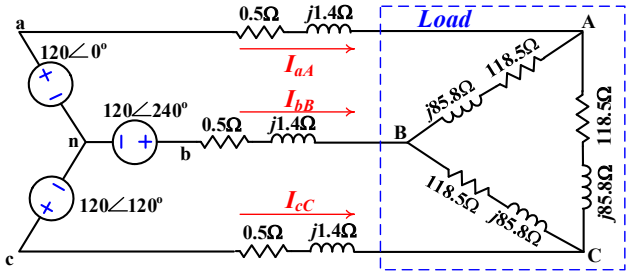

Figure of Problem 5

(1) Construct a single-phase equivalent circuit of the three-phase system.

(2) Calculate the line currents $\boldsymbol{I}_{aA}$, $\boldsymbol{I}_{bB}$, and $\boldsymbol{I}_{cC}$.

(3) Find the total 3 phase complex power absorbed by the load.

Solution of Problem 5:

6. **(15 points)** The switch has been open for a long time. $v_C(0\text{-}) = 0$. At $t = 0$, the switch is closed. Use Laplace domain method to find $v_C(t)$ (t > 0).

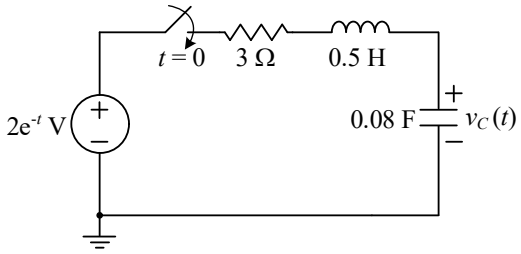

Figure of Problem 6

Solution of Problem 6:

7. **(15 points)** For $t<0$, the switch S_1 has been open for a long time; the switch S_2 has been in **Position *a*** for a long time. At $t = 0$, S_1 is closed and S_2 was switched from Position ***a*** **to *b***. Find $V_c(t)$ (t > 0) using

(1) Laplace domain (Laplace transform) method;

(2) Time-domain analysis method.

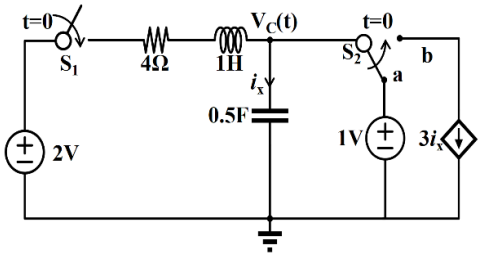

Figure of Problem 7

Solution of Problem 7:

(Cont' Solution of Problem 7)

Scratch Paper **1** (4 scratch papers in total. Please remove this page from the exam book)

Scratch Paper **2** (4 scratch papers in total. Please remove this page from the exam book)

Scratch Paper **3** (4 scratch papers in total. Please remove this page from the exam book)

Scratch Paper **4** (4 scratch papers in total. Please remove this page from the exam book)