EE1101: Circuits and Network Analysis

Assignment - 08

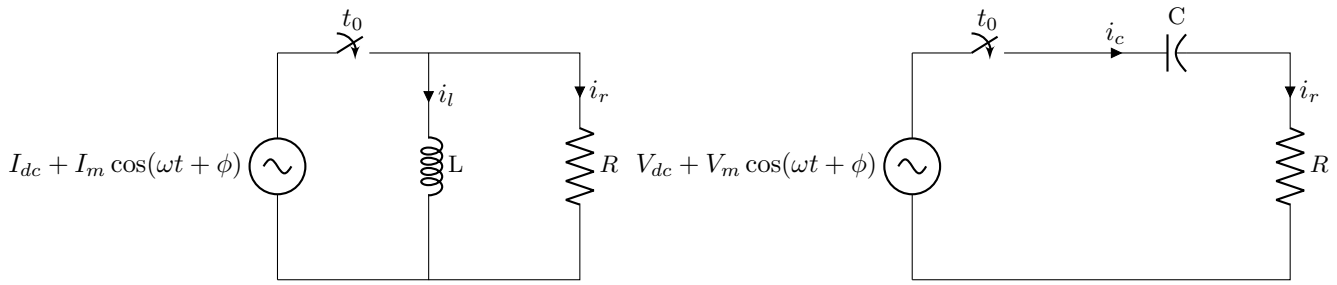
Handed out: 27 - Sep - 2024 **Due : 15 - Oct - 2024 (before 5 PM)**

Instructions :

1. Please upload your assignment solutions to the course page on the Canvas platform. Only solutions submitted through canvas will be reviewed. For specific guidelines, refer to the instructions provided on the course page.
2. It is suggested that you attempt all the problems. However, it is sufficient to submit solutions for problems that total 10 points.
3. Submissions received after the deadline will attract negative marking. Ensure that your submissions are named in the following format: RollNo-Assignment-08.pdf.

---

1. (8 points) Consider the first-order circuits shown in Fig. 1.



(a) Circuit 1 (b) Circuit 2

Fig. 1: Simple first order circuits (question 1)

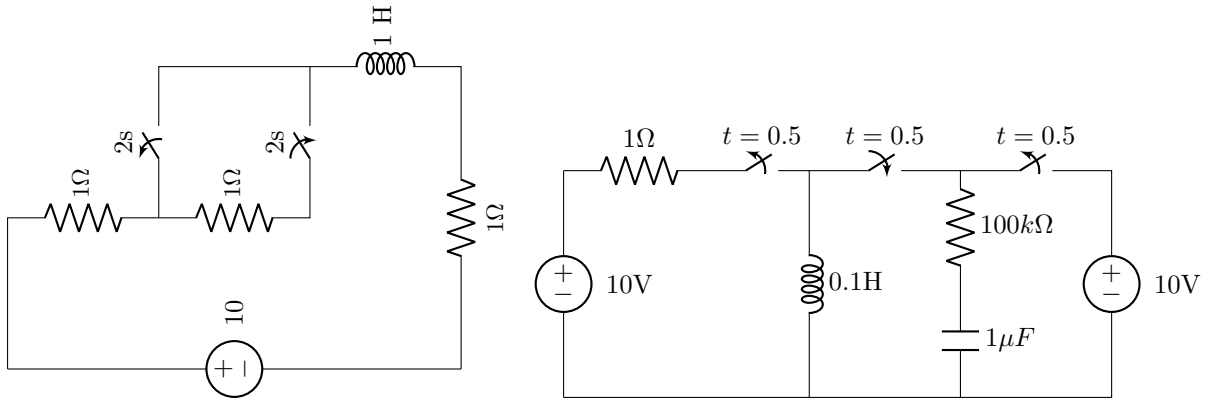
   (a) (4 points) Compute the voltage across the resistor and the current through the inductor for the circuit shown in Fig. 1(a). Assume that $i_l(t_0-) = 0$.

   (b) (4 points) Compute the voltage across the capacitor and the current through the resistor for the circuit shown in Fig. 1(b). Assume that $v_c(t_0-) = 0$.

2. (2 points) For the circuit shown in Fig. 2(a), derive an expression for the current through the inductor. Also, plot the inductor current. Assume the initial value of inductor current to be 0.

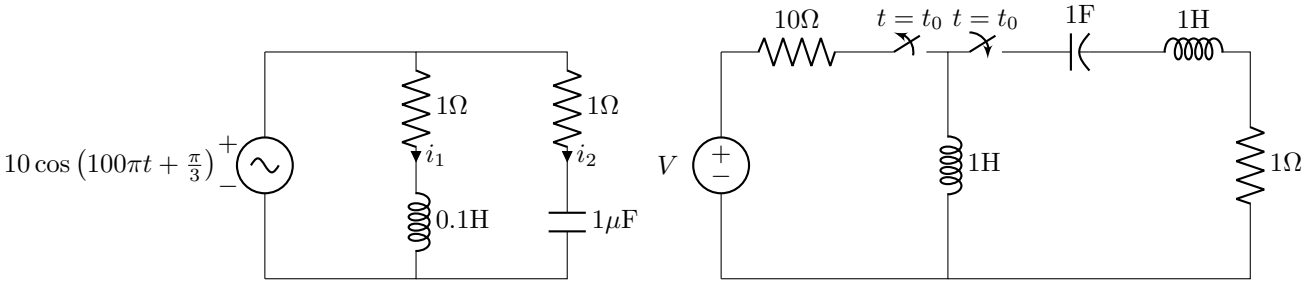
3. (4 points) For the circuit shown in Fig. 2(b), derive an expression for the inductor current and the capacitor voltage. Also, plot the inductor current and capacitor voltage. Assume the initial value of inductor current and capacitor voltage to be 0.

4. (4 points) For the circuit shown in Fig. 3(a), compute the active and reactive power (in sinusoidal steady state) associated with branches 1 and 2 (whose currents are denoted by i_1 and i_2 respectively.)



(a) RL circuit (question 2) (b) Circuit with 2 energy storage elements (question 3)

Fig. 2: First and Second order circuits

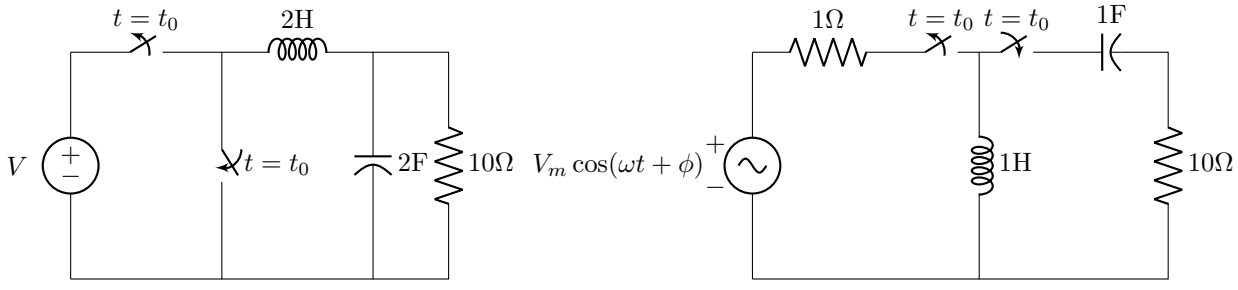


(a) Circuit for question 4 (b) Circuit for question 5

Fig. 3: Circuits for questions 4 and 5

5. (4 points) For the circuit shown in Fig. 3(b), derive an expression for the current through the inductor L_1 and the capacitor voltage. Also, plot the inductor current and capacitor voltage. Assume t_0 is sufficiently large for the circuit to be in steady state prior to t_0.

6. (4 points) For the circuit shown in Fig. 4(a), derive an expression for the current through the inductor and voltage across the capacitor. Also, plot the inductor current and capacitor voltage. Assume t_0 is sufficiently large for the circuit to be in steady state prior to t_0.



(a) Circuit for question 6 (b) Circuit for question 7

Fig. 4: Circuits for questions 6 and 7

7. (4 points) For the circuit shown in Fig. 4(b), derive an expression for the current through the inductor L_1 and the capacitor voltage. Also, plot the inductor current and capacitor voltage. Assume t_0 is sufficiently large for the circuit to be in steady state prior to t_0.