

Exam 1

ME/EE 345 Mechatronics — Version A

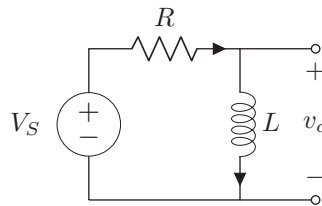
8 October 2025 — 80 minutes

Rico A. R. Picone

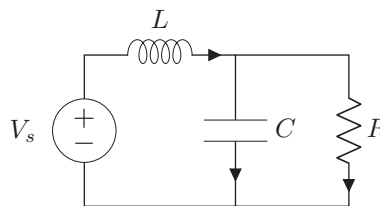
Name: _____

Instructions: In class exam. Open notes, closed book, closed computer. Calculator is allowed. Partial credit may be given. Use your own paper. Write your name in the space provided.

Problem 1 (30 points). For the RL circuit diagram below, perform a complete circuit analysis to solve for $v_o(t)$ if $V_S(t) = A$, where $A \in \mathbb{R}$ is a given but unspecified constant. Let $i_L(t)|_{t=0} = 0$ A. Hint: Solve a differential equation for $i_L(t)$.



Problem 2 (20 points). For the circuit diagram below, solve for the steady-state current $i_R(t)$ if $V_S(t) = A\angle\phi$. *Do* write V_S and the impedance of each element in phasor/polar form. *Do not* substitute V_S or the impedance of each element into your expression for $i_R(t)$. Recommendation: Use a divider rule.



Problem 3 (25 points).

In each of the figures of figure 1, solve for the voltage v_{10} across the 10Ω resistor. Use the assumptions in the associated caption. Clearly justify each response.

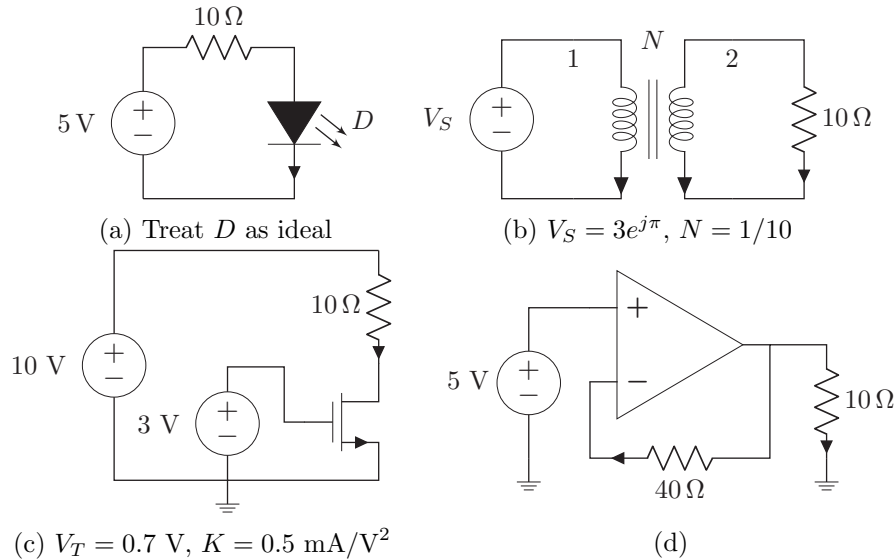


Figure 1: Circuits.

Problem 4 (25 points). Write a one- or two-sentence response to each of the following questions and imperatives. The use of equations is acceptable when they appear in a sentence. Simple diagrams are acceptable. Don't quote me (use your own words, other than technical terminology).

- If the current through an inductor is suddenly switched off, what happens?
- Let the output voltage of a resistor circuit be 5 V and the equivalent resistance 500 Ω . What is the Thevenin equivalent circuit?
- In the preceding part of this question, what is the Norton equivalent?
- When can we use impedance analysis?