The rules:

- First, relax. If you get stuck on a problem, move on.
- Open book (but only the class text).
- Closed notes.
- Calculators are permitted.
- All work must be your own. Merely looking at the work of others is cheating and is grounds for failure (and possibly decertification).
- Neatness counts. If I can’t easily read it, you won’t get credit.
- This is not a race. You don’t get any credit for finishing early.
- Hand in your test promptly and quietly at the end of the class.
- The value of each question is indicated within brackets (e.g., [10]).
- If you want to add a label to a circuit, feel free to do so, but make sure you clearly indicate any assumed direction or polarity.
1. The capacitor shown below has a charge of 10 V when the switch closes at time zero.

(a) [5] Draw the representation of the circuit in the Laplace domain.

(b) [10] Find $V_c(s)$.

(c) [5] What is the time-domain expression for $v_c(t)$?
2. In the circuit shown below, the input is \( v_g(t) \) and the output is the capacitor voltage \( v_c(t) \).

(a) [5] Find the transfer function.

(b) [5] What is the corresponding impulse response for this transfer function?

(c) [15] Assume the input is \( v_g(t) = u(t) \). Use the convolution integral to obtain the output \( v_c(t) \).
3. A system has a transfer function given by

\[ H(s) = \frac{100}{s + 10}. \]

The time-domain input to the system is \( x(t) = tu(t) \) and the output is \( y(t) \).

(a) [20] Obtain the partial-fraction expansion for the \( Y(s) \).

(b) [5] What is the time-domain representation of the output?
4. Consider the circuit shown below where the input is $v_g(t)$ and the output is $v_0(t)$.

(a) [15] Find the transfer function (express as a rational function).

(b) [15] Assume $v_g(t) = u(t)$, $R = 2 \ \Omega$, $C = 1/12 \ \text{F}$, and $L = 3/2 \ \text{H}$. What is the time-domain output $v_g(t)$?