1) Given the voltage:

\[ V(t) \]

Find \( V(s) \).

2) Given the function:

\[ f(t) = ke^{-at+b} \cdot u(t) \]

Find \( F(s) \).

3) Given the circuit:

\[ V_g(t) = 5 \cdot \sin(2t) \cdot u(t) \]

\[ R = 10 \Omega \]
\[ L = 2 \text{ mH} \]
\[ C = 1 \mu F \]

\[ i_L(t=0^-) = 100 \text{ mA} \]
\[ V_o(t=0^-) = 2 \text{ V} \]
Use Laplace transform to find $v_o(t)$.

4) a) Given the circuit:

$$V_g \quad (\pm) \quad \text{R} \quad (\pm) \quad C \quad \downarrow \quad V_o$$

$$R = 100 \, k\Omega \quad C = 1 \mu F$$

Determine $H(s) = \frac{V_o(s)}{V_g(s)}$.

Where are the poles and zeros?

b) Given the circuit:

$$V_g \quad (\pm) \quad \text{R} \quad \text{R} \quad \text{R} \quad \downarrow \quad V_o$$

$$R = 100 \, k\Omega \quad C = 1 \mu F$$
Choose the following tree:

\[ \begin{array}{c}
V_g \\
\text{\textcircled{1}} \\
\text{\textcircled{2}} \\
\text{\textcircled{3}} \\
\text{\textcircled{4}} \\
\end{array} \]

Use the mesh-current method explained in class to find \( j_2(s) \), from there find \( V_0(s) \), and from there find:

\[ H(s) = \frac{V_0(s)}{V_g(s)} \]

Determine the poles and zeros.

c) Given the circuit:

\[ \begin{array}{c}
V_g \\
\text{\textcircled{1}} \\
\text{\textcircled{2}} \\
\text{\textcircled{3}} \\
\end{array} \]

Determine \( H(s) = \frac{V_0(s)}{V_g(s)} \)
d) Given the circuit:

\[ H(s) = \frac{V_o(s)}{V_g(s)} \]

Determine where are the poles and zeros?

5) Given the circuit:

\[ R_1 = R_2 = 10 \Omega \text{ k} \Omega \]
\[ C_1 = C_2 = 1 \mu F \]
\[ V_g = 10 \text{ V} \]
\[ V_o(s) = \text{no initial energy} \]
a) Find $V_0(s)$.

b) Using the final value theorem, what would you expect:
\[
\lim_{t \to \infty} V_0(t)
\]
to be?

c) Determine $V_0(t)$ using partial fraction expansion.

d) Sketch $V_0(t)$ as a function of time.

e) What is the "true" value of:
\[
\lim_{t \to \infty} V_0(t)
\]?

f) When does the Opamp saturate?

g) What is the value of:
\[
\lim_{t \to \infty} V_0(t)
\]
taking saturation into account?