GEORGIA INSTITUTE OF TECHNOLOGY
School of Electrical and Computer Engineering

Course ECE 2040

Circuit Analysis

Assigned: October 6, 2000
Due: October 13, 2000

Problem Set #7

Reading: Read the following sections from the class notes:
Chapter 5, Section 5.5.2, 5.5.3
Chapter 6, Sections 6.1

Reading: Read the following sections from Dorf and Svoboda:
Chapter 14, Section 14.4; (singularity functions)
Chapter 8, Sections 8.3, 6.6. (first-order circuits)

Problem 7.1: Find the inverse Laplace transform of

$$X(s) = \frac{s+3}{s^3 + 3s^2 + 6s + 4}.$$

Problem 7.2: Find the inverse Laplace transform of

$$X(s) = \frac{5s-1}{s^3 - 3s - 2}.$$

Problem 7.3: Find the signal $x(t)$ for $t \geq 0$ if its Laplace transform is

$$X(s) = \frac{s^3}{(s+1)([s+1]^2 + 4)}.$$

Problem 7.4: Determine the differential equation whose solution is the voltage drop $v(t)$ in the circuit in Figure 1. Also determine the value of $v(0)$.

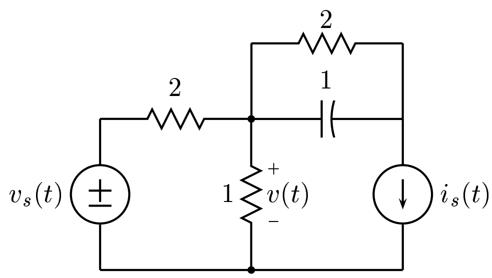

Figure 1: A first-order circuit with two sources for Problem 6.2.

Problem 7.5: Determine the differential equation and initial condition that relates $v_{out}(t)$ to $v_{in}(t)$ in the circuit in Figure 2. Assume that the current flowing through the inductor is zero at $t = 0$.

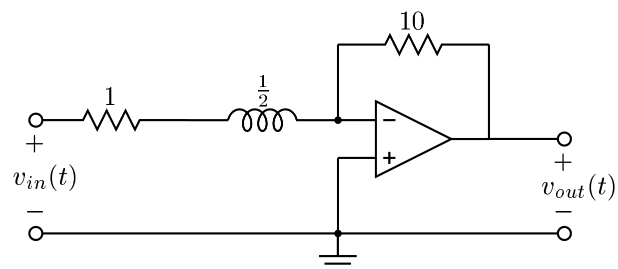

Figure 2: A first-order circuit at initial rest for Problem 6.3.

Problem 7.6: Determine the solution of each of the following differential equations for $t > 0$.

(a) $\frac{dy(t)}{dt} + 2y(t) = 3, \quad y(0) = 0$

(b) $2\frac{dy(t)}{dt} + y(t) = e^{-t}, \quad y(0) = 0$

(c) $\frac{dy(t)}{dt} + \frac{1}{5}y(t) = e^{-t}e^{jt}, \quad y(0) = 1$