Chapter 2 problems 14, 18, 20

14)
This is a voltage divider between the inductor (1 s) and the resistor-capacitor combination (1+1/s).

Therefore

$$\frac{Vo(s)}{Vi(s)} = \frac{s}{s + (1+1/s)} = \frac{s^2}{s^2 + s + 1}$$

18)
The nodal equations for this circuit are written with the following nodes: Vout (which is between the 3 Henry Inductor and the 4 Ohm resistor), Va (which is between the 1 Ohm and 2 Ohm resistors).

Recalling our 210 and 305 knowledge, we write (remember we replace Inductors with L*s, Capacitors with 1/sC, and Resistors with R)

$$\frac{Va - v}{1} + \frac{Va}{1 + 2s} + \frac{Va - Vout}{2 + 3s} = 0$$

$$\frac{Vout}{4} + \frac{Vout - Va}{2 + 3s} + \frac{Vout - v}{5/s} = 0$$

It _should_ be clear to you how to solve for G(s) = Vout(s) / v(s) from here (you can eliminate Va from the two equations in a variety of ways).

20)
Clearly v1(t) = vi(t) since V+=V- always.

Doing nodal analysis at V-, we can see that

$$\frac{Vi}{200000 + 1/s*1e-6} + \frac{Vi - Vo}{100000 + 1/s*1e-6} = 0$$

Which can be rewritten as

$$\frac{Vo(s)}{Vi(s)} = 1.5 * \frac{s + (20/3)}{s + 5}$$