5.1

```
                      G6G4+G6G3+G6G5G3+G6G5G2
TF = -------------------------------------------------------------
     1+G6+G3G1+G2G1+G7G6G4+G7G6G3+G7G6G5G3+G7G6G5G2+G6G3G1+G6G2G1
```

5.3

Proceed by

i) Combine the cascade s's
    s^2
ii) simplify parallel branch
    (s^3+1)/s

iii) rewrite the summation junction as two summation junctions
    (just like we did in class)

iv) simplify the unity feedback

    (s^3+1)/(s^3+s+1)

v) combine the cascade blocks
    (s^3+1)/(s^4+s^2+s)

vi) simplfy the feedback with H(s) = s
    (s^3+1)/(2s^4+s^2+2s)   <--- Answer

5.4

Proceed by

i) Simplify the unity feedback
    50s/(s^2+s+100)

ii) Simplify the parallel branch
    (s-2)

iii) Combine the 3 cascade blocks
    50s(s-2)/(s^2)(s^2+s+100)

iv) Simplify the unity feedback
    50(s-2)/(s^3+s^2+150s-100) <--- Answer

5-13

G(s)=s/(2s+2),

found via

(a) Change the '2' block to '2/s', by moving the pickoff point from before the 's' to after the 's'.

(b) combine the parallel '1/s' and '1' to (s+1)/s

(c) simplify the feedback 's' and '1' to s/(s+1)

(d) realize that the (2/s) in feedback and the 1 in feedback are in parallel and combine to a simple (s+2)/s in feedback

The poles are clearly at s=-1

5-15

Find that

G(s) = k/(s^2+alpha s + k)

We know that 40% OS means zeta=0.28. Given Ts=.5s, we find that wn=28.57.

This allows us to solve for k and alpha and find k=816.24, alpha=16.

5-52

a) This is straightforward. We find that OS=73%, Ts=8s.

b) First, simplify the this to a single block TF. We find that G(s)=25 K1 / (s^2 + (1+25K2)s + 25K1).

We would like 25% OS (zeta=.404) and .2s Ts (wn=49.5). We can find K1 and K2 easily. K1=98.01, K2=39/25.