Chapter 7

7-1

error = lim s->0 sR(s)/(1+G(S))

for step (R(s) = 1 /s), error = 0
for ramp (R(s) = 1/s^2), error = 0
for 50t^2 (R(s) = 100/s^3), error = 0.43

7-3

Reduce to an equivalent unity feedback system

$$G(S) = \frac{5}{s^2+16s+15}$$

and lim s->0 G(s) = Kp = 1/3

finally, the error due to 15 u(t) is 15 * 1/(1+Kp) = 11.25

7-4

This system is of type 0. Using the table, we quickly find

ramp error = Infinity
parabola error = Infinity

and for 35 u(t), error = 35 * 1/(1+Kp) = 7

7-9

The closed loop transfer function is found to be

$$T(s) = \frac{1250}{s^2 + 50s + 1250}$$

from which we can find wn=sqrt(1250), and zeta=.707

a) The overshoot is therefore 4.32%
b) Ts=4/zeta*wn = .16 s
c) error step = 0, it is a type 1 system.
d) Kv=25, and error ramp = 5*(1/25) = .2
e) error parabola = Infinity.

7-14

This can be simplified to the unity feedback system with

$$G(s) = \frac{5s + 10}{2s\,(s+1)}$$

This is a type 1 system because of the 2s.