Solution of ECE 316 Test #6 S03 2/26/03

1. A system has a transfer function, $H(s) = \dfrac{20}{s^2 + 4s + 10}$. If this system is excited by a unit step, what is the final value of the response (as $t \to \infty$) ?

The Laplace transform of the unit-step response is

$$H_{-1}(s) = \frac{1}{s} \frac{20}{s^2 + 4s + 10} \ .$$

Therefore, by the final-value theorem,

$$\lim_{t \to \infty} h_{-1}(t) = \lim_{s \to 0} s\,H_{-1}(s) = \lim_{s \to 0} \frac{20}{s^2 + 4s + 10} = 2$$

2. Classify the filters with the pole-zero diagrams below as lowpass, highpass, bandpass or bandstop.

(a) Highpass (b) Lowpass (c) Bandpass (d) Bandstop

(a)   (b)

(c)   (d)

Triple zero
at $s = 0$