**ENGR 3323: Signals and Systems**

**HW 6_Ch4 Answer Keys**

**1)**

a) $y(t) = \underbrace{(2+5t)e^{-2t}}_{y_{zir}(t)} + \underbrace{te^{-2t}}_{y_{zsr}(t)}$

b) $y(t) = \underbrace{[\sqrt{2}e^{-3t}\cos(4t-\frac{\pi}{4})]}_{y_{zir}(t)} + \underbrace{[2+5.154e^{-3t}\cos(4t-112.83°)]}_{y_{zsr}(t)}$

**2)**

a) $H(s) = \dfrac{2s-1}{s^2+3s+2}$

b) $h(t) = [-3e^{-t} + 5e^{-2t}]u(t)$

c) $y_{zir}(t) = -4e^{-t}u(t) + e^{-2t}u(t)$.

d) $y_{zsr}(t) = \left[-\dfrac{1}{2} + 3e^{-t} - \dfrac{5}{2}e^{-2t}\right]u(t)$

**3)** At $t$ =0, the inductor current $y_1(0) = 4$ and the capacitor voltage is 16 volts. After $t = 0$, the loop equations are

a) $$2\frac{dy_1}{dt} - 2\frac{dy_2}{dt} + 5y_1(t) - 4y_2(t) = 40$$

$$-2\frac{dy_1}{dt} - 4y_1(t) + 2\frac{dy_2}{dt} + 4y_2(t) + \int_{-\infty}^{t} y_2(\tau)\,d\tau = 0.$$

b) $$y_1(t) = [8 + 17.89e^{-1.5t}\cos(\frac{t}{2} - 26.56°)]u(t)$$

$$y_2(t) = 20\sqrt{2}e^{-1.5t}\cos(\frac{t}{2} - \frac{\pi}{4})u(t).$$

**4)**

a) i) $y_1(t) = [6 + 9.22e^{-t}\cos(2t - 130.6°)]u(t)$

ii) $y_2(t) = \dfrac{1}{10}\{6 + 9.22e^{-(t-5)}\cos[2(t-5) - 130.6°]\}u(t-5)$

b) $\ddot{y}(t) + 2\dot{y}(t) + 5y(t) = 2\dot{x}(t) + 3x(t)$

**5)**

a) $y_{ss}(t) = 7.5u(t)$

b) $y_{ss}(t) = \dfrac{\sqrt{13}}{8}\cos(2t + 3.69°)u(t)$

c) $y_{ss}(t) = \dfrac{\sqrt{18}}{13}\sin(3t - 112.62°)u(t)$

d) $y_{ss}(t) = \dfrac{\sqrt{18}}{13}e^{j[3t-67.62°]}u(t)$