1. [16] 11.15 b,d from Ambardar.

2. [10] A linear time-invariant system has transfer function \( H(s) = \frac{s + 2}{(s + 1)^2 + 4} \). The input \( x(t) = C \cos(\omega_0 t + \theta) \) is applied to the system with zero initial energy. The resulting steady-state response \( y_{ss}(t) = 6 \cos(t + 45^\circ) \). Compute \( C, \omega_0, \theta \).

   a) Find \( H(\omega) \), the frequency response of this system.
   b) Find the magnitude and phase response.
   c) Find the half-power frequency for this filter.
   d) Sketch the magnitude and the phase responses.
   e) Use the following MATLAB code for plotting the magnitude and phase responses.

   ```matlab
   % If \( H(s) = \frac{b_0 s^n + b_1 s^{n-1} + \cdots + b_n}{a_0 s^m + a_1 s^{m-1} + \cdots + a_m} \), then define two vectors;
   % \( b = [b_0 \ b_1 \cdots b_n] \);
   % \( a = [a_0 \ a_1 \cdots a_m] \);
   % define a vector of frequencies over which you want to plot the magnitude
   % and phase response, e.g. \( w=[0:0.1:2*\pi] \);
   % the following command will give you the magnitude and phase responses;
   freqs(b,a,w);
   ```

4. [12] Sketch the magnitude response for a system with \( H(s) = \frac{s^2 + 2}{(s + 2)^2} \). (Hint: You can do this by just looking at the pole-zero diagram of the system.)
5. A linear time-invariant system has transfer function $H(\sigma)$ with $H(0)=3$. The transient response resulting from the step function input with the system at rest at $t=0$ has been determined to be $y(t) = (−2e^{−\sigma t} + 4e^{−3\sigma t})u(t)$. (Hint: The transient response is just the natural response of the system)

   a. Find the forced response for this system.
   b. Compute the system’s transfer function $H(\sigma)$.
   c. Compute the steady-state response when the system’s input is equal to $2\cos(3t + 60^0)$.

6. 8.44 from Ambardar.