Prob. 1

Reproduction of Figure 11.6.3 can be found in Fig. 1 (a) and (b). The order 7 filter magnitude response (in dB) and phase response can be found in Fig. 1 (c) and (d), while the order 13 filter magnitude response (in dB) and phase response can be found in Fig. 1 (e) and (f).

Prob. 2

Butterworth LPF with $\omega_c = 3\pi/5$ for orders 3, 8, and 15 is shown in Figure 2 (a). We see that for all filters, $|H(\omega_c)|^2 = 0.5$. The phase response and group delay of the 8th order Butterworth is shown in Figure 2 (b) and (c) and we note the non-linear phase.

Prob. 3

Reproduction of Figure 11.6.11 can be found in Fig. 3 (a) and (b). The order 4 filter magnitude response (in dB) and phase response can be found in Fig. 3 (c) and (d), while the order 6 filter magnitude response (in dB) and phase response can be found in Fig. 3 (e) and (f).

Prob. 4

Chebyshev LPF with $\omega_c = 3\pi/5$ for orders 3, 8, and 15 and $\varepsilon = 0.3$ is shown in Figure 4 (a) and (b). We see that for all filters, (i) the passband ripples between 1 and $1/(1+\varepsilon) = 0.92$, (ii) the DC gain is either 1.0 or 0.92 depending on odd or even filter order, and (iii) $|H(\omega_c)|^2 = 0.5$. The phase response and group delay of the 8th order Chebyshev is shown in Figure 4 (b) and (c) and we note the non-linear phase.

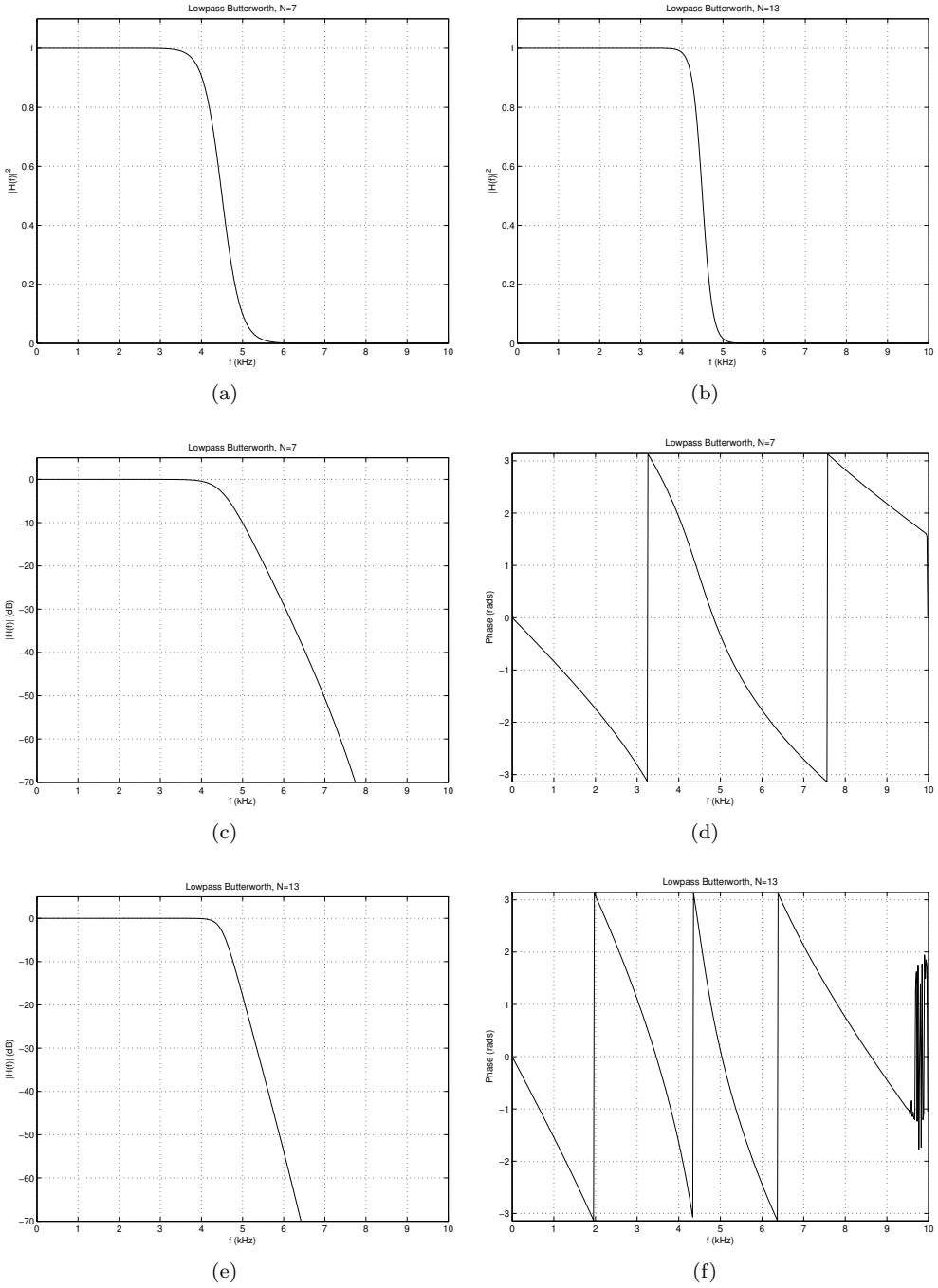

Figure 1: Plots for Prob. 1 (a) reproduction of Figure 11.6.3(a), (b) reproduction of Figure 11.6.3(b), (c) magnitude response (in dB) for $N = 7$, (d) phase response for $N = 7$, (e) magnitude response (in dB) for $N = 13$, (f) phase response for $N = 13$.

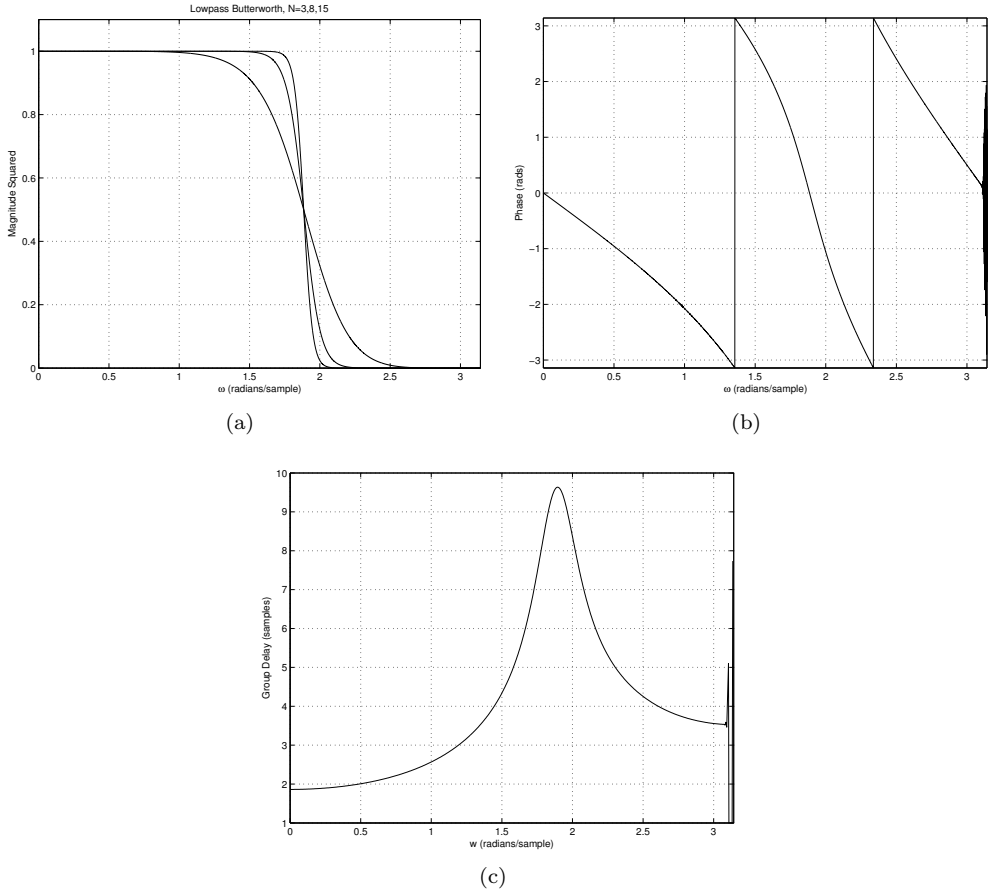

Figure 2: (a) Butterworth LPF with $\omega_c = 3\pi/5$ for orders 3, 8, and 15; (b) phase response and (c) group delay of the 8th order Butterworth.

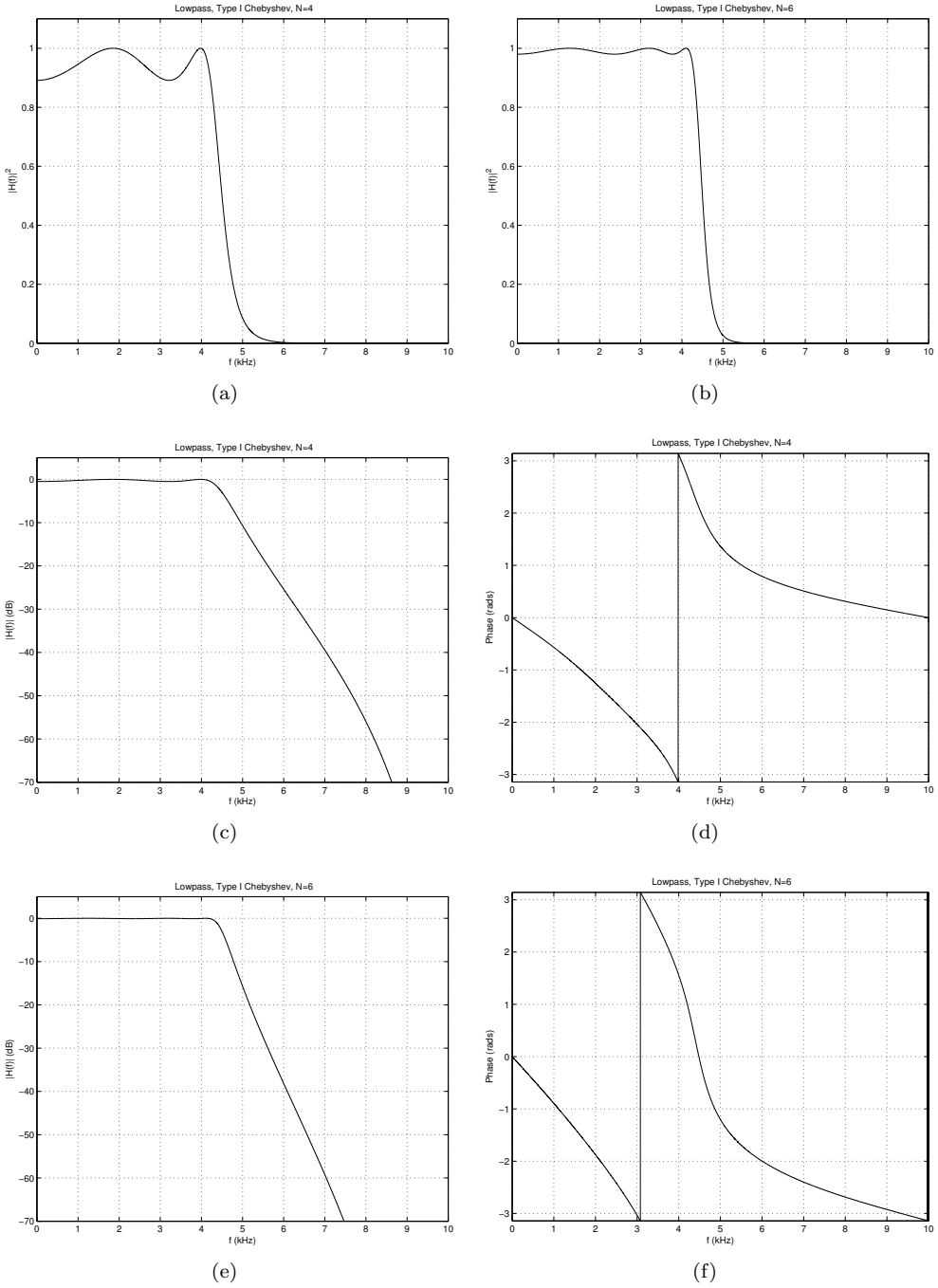

Figure 3: Plots for Prob. 3 (a) reproduction of Figure 11.6.11(a), (b) reproduction of Figure 11.6.11(b), (c) magnitude response (in dB) for $N = 4$, (d) phase response for $N = 4$, (e) magnitude response (in dB) for $N = 6$, (f) phase response for $N = 6$.

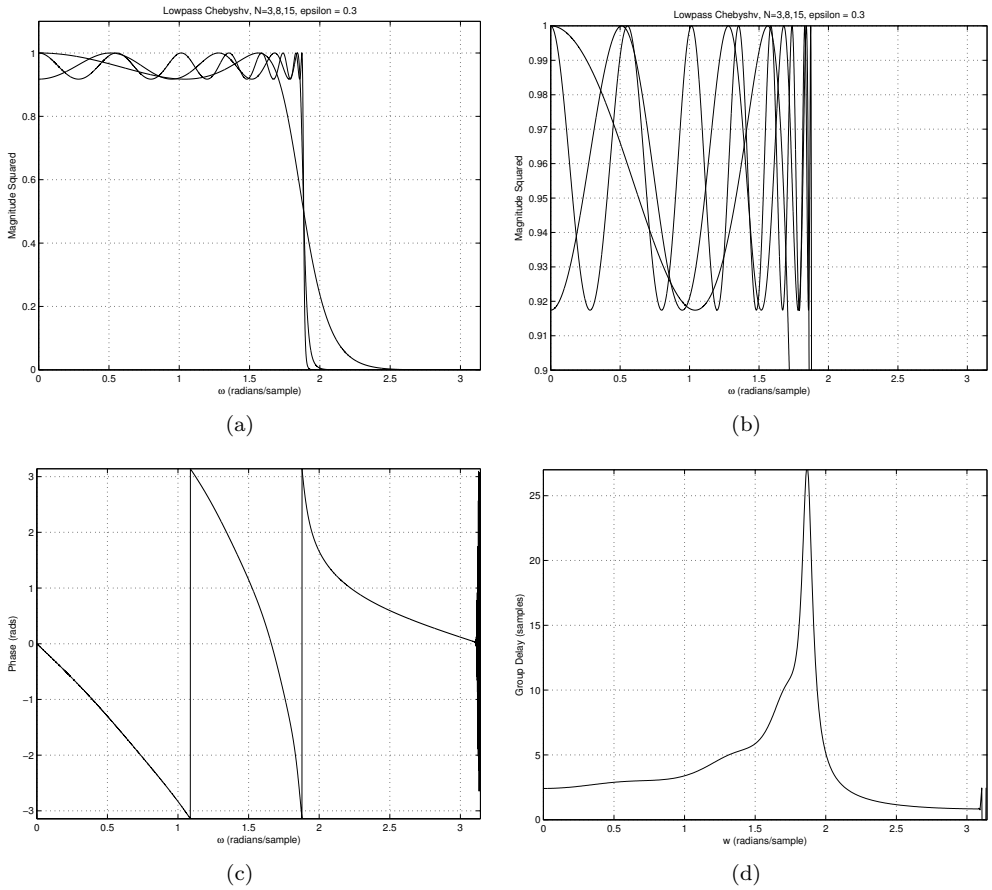

Figure 4: (a) Chebyshev LPF with $\omega_c = 3\pi/5$ for orders 3, 8, and 15 and $\varepsilon = 0.3$; (b) "zommed-in" passband; (c) phase response and (c) group delay of the 8th order Chebyshev.