EE 451 – HW2

3.6. **(a)** $\int_{-\infty}^{\infty} x(t-t_0)e^{-j\omega t}\,dt = \int_{-\infty}^{\infty} x(\tau)e^{-j\Omega(\tau - t0)}\,d\tau = e^{-j\Omega\, t0}\int_{-\infty}^{\infty} x(\tau)e^{-j\Omega\tau}\,d\tau$

(b) $\int_{-\infty}^{\infty} x(t)\, e^{-j\,\Omega 0\, t}\, e^{-j\,\Omega\, t}\,dt = \int_{-\infty}^{\infty} x(t)e^{-j(\Omega - \Omega 0)t}\,dt$

3.14 $G(e^{-j\omega}) = 1 - H_{LP}(e^{-j\omega})$

3.22 **(a)** h[n] = {-j/2,0,0,0,0,0,0,0,j/2}
(b) h[n] = {1/2,0,0,0,0,0,0,0,1/2}

3.33 **(a)** Even
(b) Even

M3.3

```
% Compute freq represenataion of rational polynomials
close all
w=0:pi/100:pi;
n1=0.2418*(1+0.139*exp(-j*w)-0.3519*exp(-j*2*w)+0.139*exp(-j*3*w)+exp(-
j*4*w));
d1=1+0.238*exp(-j*w)+0.8258*exp(-j*2*w)+0.1393*exp(-j*3*w)+0.4153*exp(-
j*4*w);
x1=n1./d1;
n2=0.1397*(1-0.0911*exp(-j*w)+0.0911*exp(-j*2*w)-exp(-j*3*w));
d2=1+1.1454*exp(-j*w)+0.7275*exp(-j*2*w)+0.1205*exp(-j*3*w);
x2=n2./d2;

% Plot real, imaginary, magnitude, phase
subplot(2,2,1); plot(w,real(x1)); title('Real part'); xlabel('w');
ylabel('Amp.'); grid
subplot(2,2,2); plot(w,imag(x1)); title('Imag part'); xlabel('w');
ylabel('Amp.'); grid
subplot(2,2,3); plot(w,abs(x1)); title('Mag spectrum'); xlabel('w');
ylabel('Mag.'); grid
subplot(2,2,4); plot(w,atan2(imag(x1),real(x1))); title('Phase
spectrum'); xlabel('w'); ylabel('Rads'); grid

figure
subplot(2,2,1); plot(w,real(x2)); title('Real part'); xlabel('w');
ylabel('Amp.'); grid
subplot(2,2,2); plot(w,imag(x2)); title('Imag part'); xlabel('w');
ylabel('Amp.'); grid
subplot(2,2,3); plot(w,abs(x2)); title('Mag spectrum'); xlabel('w');
ylabel('Mag.'); grid
subplot(2,2,4); plot(w,atan2(imag(x2),real(x2))); title('Phase
spectrum'); xlabel('w'); ylabel('Rads'); grid
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