Digital Signal Processing ENGR 4333/5333

Test 2

Date: **Time:** **Name:**

Q1) Use convolution definition to find the zero-state response $y[n]$ for the input $x[n] = 2u[n]$ of an LTID system described by the impulse response $h[n] = (0.3)^n u[n]$.

Q2) For the LTID system descripted by the impulse response

$$h[n] = (0.6)^n u[n].$$

a) Determine the frequency response $H(\Omega)$ of the system using the DTFT definition.
b) Determine the zero-state response $y[n]$ for the everlasting input $x[n] = \cos(0.5\pi n)$.

Q3) For the LTID system specified by the difference equation

$$y[n] - 0.81y[n-2] = x[n-3].$$

a) Determine the frequency response $H(\Omega)$ of the system
b) Determine the zero-state response $y[n]$ for the input $x[n] = (0.8)^n u[n]$

Q4) The DTFT of the input $X(\Omega)$ and the frequency response of the system $H(\Omega)$ are shown below

$$X(\Omega) = \frac{0.5e^{j\Omega}}{\left(e^{j\Omega}-0.5\right)^2} \qquad H(\Omega) = e^{-j3\Omega}$$

a) Find $Y(\Omega)$
b) Find $y[n]$
c) What does the system $H(\Omega)$ do to the input?

Q5) For the signal $x[n] = 3/16\ \mathrm{sinc}(3n/16)$,
a) Find the $M = 2$ down sampled signal $x_{\downarrow}[n]$.
b) What is the maximum factor M that still permits lossless (no aliasing) down sampling?
c) Find the spectrum $X_{\downarrow}(\Omega)$ from $X(\Omega)$