ECE301

HW 6

Due on Thursday Dec. 1st

Please provide steps to explain your answer

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Office Hour change: MSEE180 (9:30am - 10:30am Monday and Wednesday)

Question 1

Consider the impulse response and input signal

$$x[n] = a^n u[n], \quad h[n] = \delta[n - n_0]$$

(a) $x_1[n] = x[n] * x[n]$
(b) $x_2[n] = x[n-1] + x[n+1]$
(c) $y[n] = x[n] * h[n]$
(d) $x_3[n] = \sum_{m=-\infty}^{n} x[m]$ Determine fourier transform of $x_1[n]$, $x_2[n]$, and $y[n]$, $X_1(e^{jw})$, $X_2(e^{jw})$, $Y(e^{jw})$, and $X_3(e^{jw})$

Question 2

Consider the periodic signal

$$x[n] = cos(w_0 n)$$

$$y[n] = sin(w_0 n)$$

(a) Determine Fourier transform of x[n], $X(e^{jw})$
(b) Determine Fourier transform of y[n], $Y(e^{jw})$
(c) Determine Fourier transform of 2x[n] + 3y[n]

Question 3

Consider an LTI system

$$\begin{aligned} x[n] &= a^n u[n] \\ y[n] &= (n+1)a^n u[n] + a^n u[n] \end{aligned}$$

where $a \neq b \neq c$.
Determine impulse response h[n]

Question 4

Consider the signals

$$\begin{aligned} x_1[n] &= (\tfrac{1}{2})^{n-1} u[n-1] \\ x_2[n] &= (\tfrac{1}{2})^{|n|} cos(\tfrac{\pi}{8}(n-1)) \end{aligned}$$

Find Fourier transform of $x_1[n]$ and $x_2[n]$, $X_1(e^{jw})$ and $X_2(e^{jw})$

Question 5

Consider an LTI system described by the following difference equation

$$y[n] - \frac{1}{2} y[n-1] = x[n]$$

(a) Determine the system's frequency response $H(e^{jw})$
(b) Determine the system's impulse response h[n]
(c) If the input signal $x[n] = (\frac{1}{3})^n u[n]$, what is the output y[n]

(Extra Points)Question 6

Given the input signal

$$x[n] = y_{(2)}[n] + 2y_2[n-1]$$

where $x[n]$ can be displayed as,

$$x[n] = u[n] - u[n-10] + \delta[n-1] + \delta[n-3] + \delta[n-5] + \delta[n-7] + \delta[n-9]$$

Find the fourier transform of $X(e^{jw})$