

Digital Signal Processing Sheet 2

Question 1:

Find which of the following signals are energy signals, power signals, neither energy nor power signals:

(a) $\left(\frac{1}{2}\right)^n u(n)$

(b) $e^{j[(\pi/3)n + (\pi/2)]}$

(c) $\sin\left(\frac{\pi}{3}n\right)$

(d) $u(n) - u(n-6)$

(e) $nu(n)$

(f) $r(n) - r(n-4)$

Question 2:

Find the even and odd components of the following signals:

① $x(n] = \left\{ \underset{\uparrow}{5}, 4, 3, 2, 1 \right\}$

② $x(n] = \left\{ 5, 4, 3, 2, \underset{\uparrow}{1} \right\}$

Question 3:

Find whether the following systems are dynamic or not:

(a) $y(n] = x(n + 2)$

(b) $y(n] = x^2(n)$

(c) $y(n] = x(n - 2) + x(n)$

Question 4:

Check whether the following systems are causal or not:

(a) $y(n] = x(n] + x(n - 2)$

(b) $y(n] = x(2n)$

(c) $y(n] = \sin[x(n)]$

(d) $y(n] = x(-n)$

Digital Signal Processing Sheet 2

Question 5:

Check whether the following systems are linear or not:

(a) $y(n) = n^2 x(n)$

(b) $y(n) = x(n) + \frac{1}{2x(n-2)}$

(c) $y(n) = 2x(n) + 4$

(d) $y(n) = x(n) \cos \omega n$

(e) $y(n) = |x(n)|$

(f) $y(n) = \frac{1}{N} \sum_{k=0}^{N-1} x(n-k)$

Question 6:

Determine whether the following systems are time-invariant or not:

(a) $y(n) = x(n/2)$

(b) $y(n) = x(n)$

(c) $y(n) = x^2(n-2)$

(d) $y(n) = x(n) + nx(n-2)$

Question 7:

Check the stability of the system defined by

(a) $y(n) = ax(n-7)$

(b) $y(n) = x(n) + \frac{1}{2}x(n-1) + \frac{1}{4}x(n-2)$

(c) $h(n) = a^n \quad \text{for } 0 < n < 11$

(d) $h(n) = 2^n u(n)$

(e) $h(n) = u(n)$

Question 8:

Find the convolution of the signals

$$x(n) = \begin{cases} 2 & n = -2, 0, 1 \\ 3 & n = -1 \\ 0 & \text{elsewhere} \end{cases}$$

$$h(n) = \delta(n) - 2\delta(n-1) + 3\delta(n-2) - \delta(n-3)$$

Given $x(n) = \left\{ \begin{matrix} 2, 3, 2, 2 \\ \uparrow \end{matrix} \right\}; \quad h(n) = \{1, -2, 3, -1\}$