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211022084

NMT 20703 : SIGNAL AND SYSTEMS

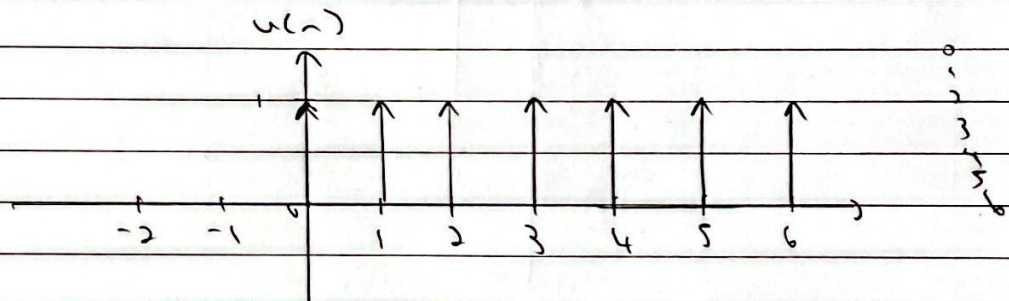
TEST

Question 1

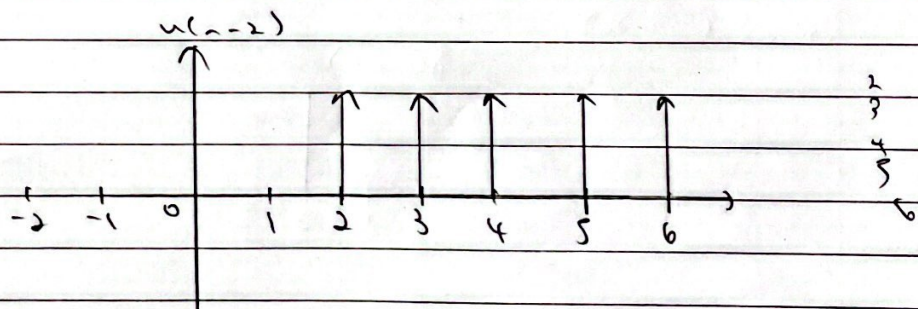
1. Sketch the waveform of the following signals,

a) $y(n] = u[n] - u[n-2]$

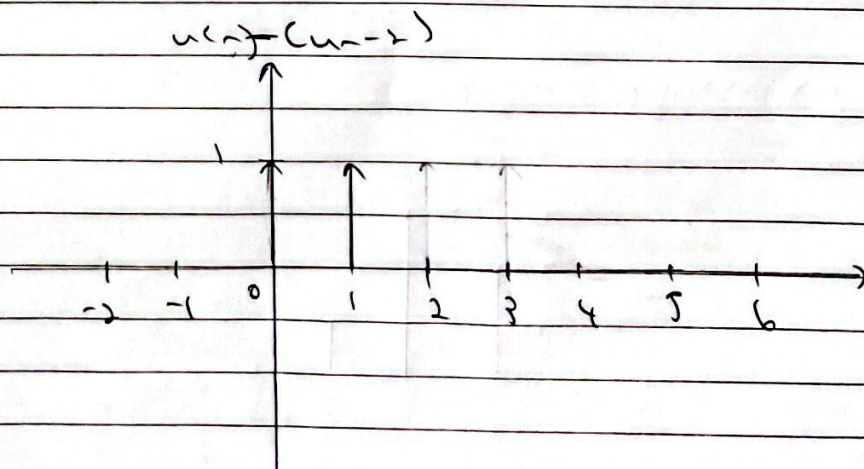
①



②

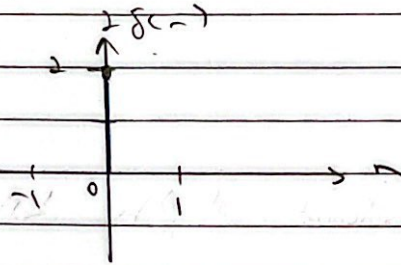


③

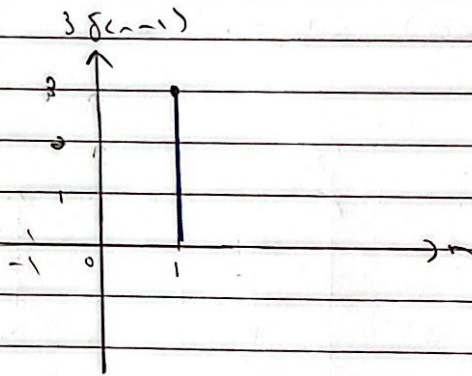


$$(b) y(n) = 2\delta(n) + 3\delta(n-1) + \delta(n-2)$$

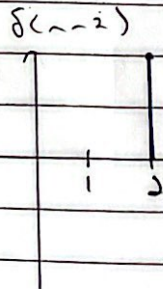
$$(1) 2\delta(n)$$



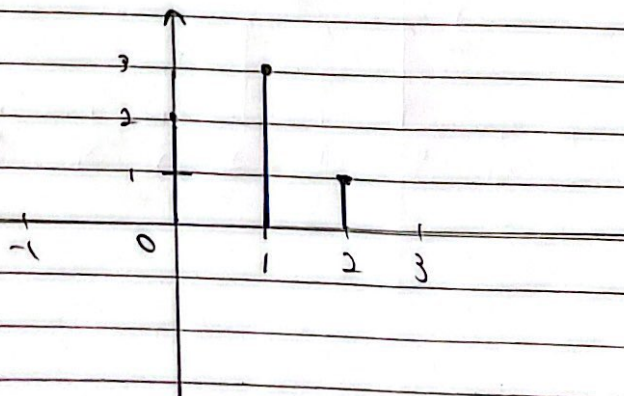
$$(2) 3\delta(n-1)$$



$$(3) \delta(n-2)$$

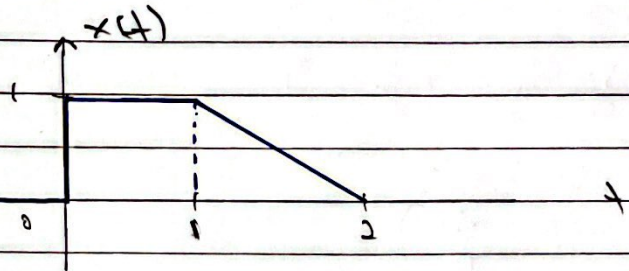


$$(4) 2\delta(n) + 3\delta(n-1) + \delta(n-2)$$



Question 2

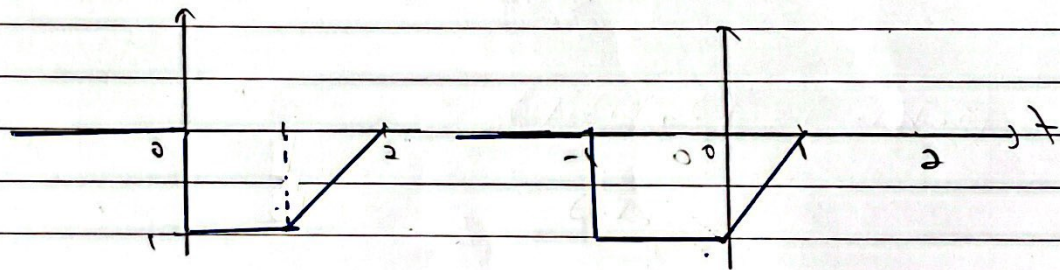
(a)



(a) $x(-t+1)$

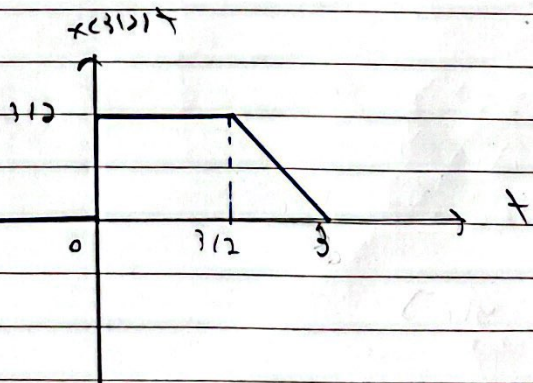
① $x(-t)$

② $x(-t-1)$



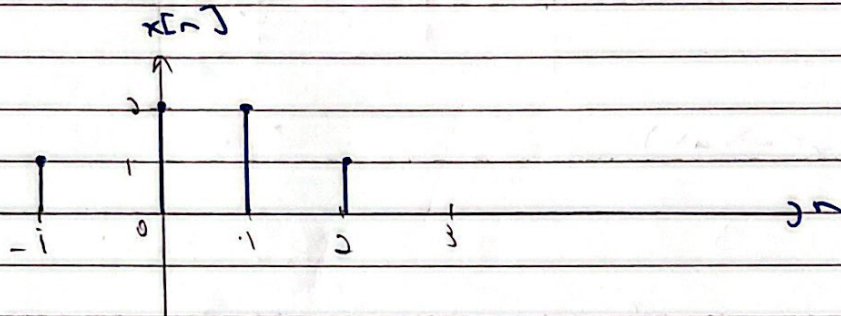
(b)

$x(3/2-t)$

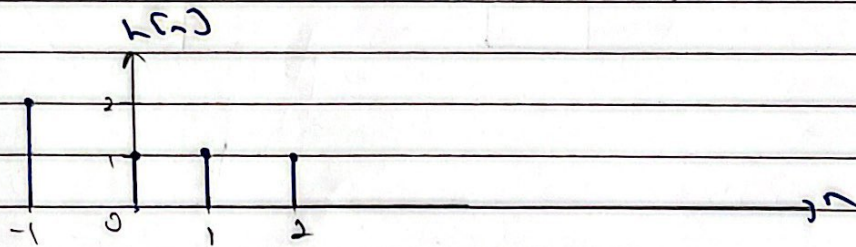


Question 3:

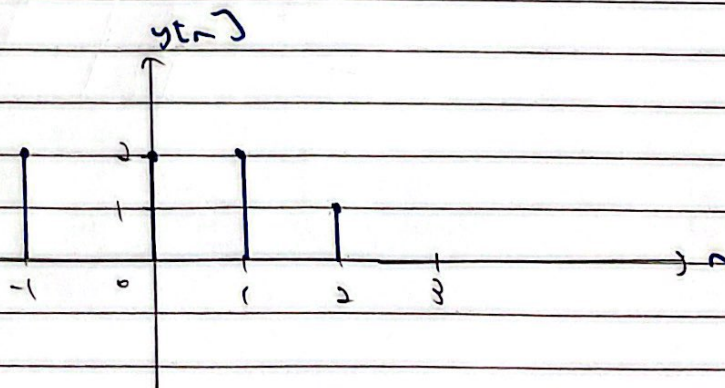
3. ① $x[n] = \{1, 2, 2, 1\}$



② $h[n] = \{2, 1, 1, 1\}$



③ $x[n] = \{1, 2, 2, 1\}$
 $h[n] = \{2, 1, 1, 1\}$
 $y[n] = \{2, 2, 2, 1\}$



Question 4

Calculate the DFT of the sample data sequence
 $x(n) = \{1, 1, 2, 0\}$

Formula

$$X[k] = \sum_{n=0}^{N-1} x[n] e^{-j2\pi kn/N} \quad , k = 0, 1, 2, \dots, N-1$$

① for $k=0$

$$X(0) = \sum_{n=0}^3 x(n) e^{-j2\pi(0)n/4}$$

$$= 1 + 1 + 2 + 0 = 4$$

② for $k=1$

$$X(1) = \sum_{n=0}^3 x(n) e^{-j2\pi(1)n/4} = x(n) e^{-j\pi n/2}$$

$$= 1 + e^{-j\pi/2} + 2e^{-j2\pi/2} + 0e^{-j3\pi/2}$$

$$= 1 + e^{-j\pi/2} + 2e^{-j\pi} + 0$$

$$= 1 + (0 - j) + 2(-1) + 0$$

$$= -1 - j$$

③ for $k=2$

$$X(2) = \sum_{n=0}^3 x(n) e^{-j2\pi(2)n/4} = e^{-j\pi n}$$

$$= 1 + e^{-j\pi(1)} + 2e^{-j\pi(2)} + 0e^{-j\pi(3)}$$

$$= 1 + (-1) + 2(1) + 0$$

$$= 2$$

(4) for $k=3$

$$x(3) = \sum_{n=0}^3 x(n) e^{-j2\pi n(3)/4} = e^{j3\pi/2}$$

$$= 1 + e^{-j3\pi(1)/2} + 2e^{-j6\pi/2} + 0e^{j9\pi/2}$$

$$= -1 + j$$

$$x(k) = \{4, -1-j, 2, -1+j\}$$

Amplitude spectrum

$$|x(k)| = \{ \sqrt{4+4}, \sqrt{(-1)^2 + (-1)^2}, \sqrt{2^2}, \sqrt{(-1)^2 + (1)^2} \}$$

$$= \{4, \sqrt{2}, 2, \sqrt{2}\}$$

Phase spectrum

$$\angle x(k) = \{ \tan^{-1}(0), \tan^{-1}\left(\frac{-1}{-1}\right), \tan^{-1}(0), \tan^{-1}\left(\frac{1}{-1}\right) \}$$

$$= \{0, 0.7054, 0, -0.7054\}$$

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