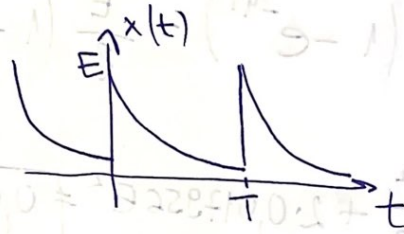


$$①. x(t) = E \cdot e^{-2t}$$

$$T = 2s$$



$$\underline{X_n} = \frac{1}{T} \int_0^T x(t) e^{-jn\omega t} dt = \frac{1}{T} \int_0^T E e^{-2t} \cdot e^{-jn\omega t} dt =$$

$$= \frac{E}{T} \cdot \int_0^T e^{-(2+jn\omega)t} dt = \frac{E}{T} \cdot \frac{-1}{2+jn\omega} \cdot e^{-(2+jn\omega)t} \Big|_0^T$$

$$= \frac{E}{T(2+jn\omega)} \cdot (1 - e^{-(2+jn\omega)T}) =$$

$$= \frac{E}{T} \cdot \frac{1 - e^{-2T} \cdot e^{-jn\omega T}}{2+jn\omega} = \frac{E}{T} \cdot \frac{1 - e^{-2T} \cdot e^{-jn2\pi}}{2+jn\omega} =$$

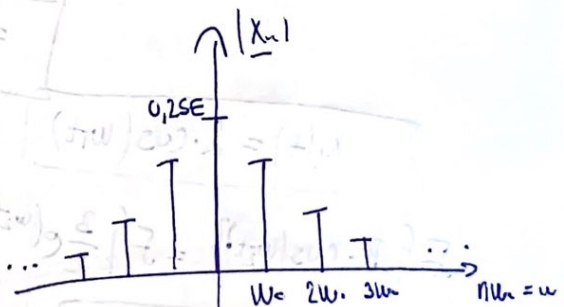
$$= \frac{E}{T} \cdot \frac{1 - e^{-2T}}{2+jn\omega} \Rightarrow \boxed{|\underline{X_n}| = \frac{E}{T} \cdot \frac{1 - e^{-2T}}{\sqrt{4 + (n\omega)^2}}}$$

$$T = 2 \Rightarrow \boxed{|\underline{X_n}| = \frac{E}{2} \cdot \frac{1 - e^{-4}}{\sqrt{4 + (n\omega)^2}}} = \frac{0,49E}{\sqrt{4 + (n\omega)^2}} \approx \frac{0,5E}{\sqrt{4 + (n\omega)^2}}$$

$$\begin{aligned} |X_0| &= 0,25E \\ |X_1| &= \frac{0,5E}{\sqrt{4 + 0^2}} = 0,134E \end{aligned}$$

$$|X_2| = \frac{0,5E}{\sqrt{4 + 40^2}} = 0,076E$$

$$|X_3| = \frac{0,5E}{\sqrt{4 + 90^2}} = 0,052E$$



$$\begin{aligned}
 d) \quad P &= \frac{1}{T} \int_T x^2(t) dt = \frac{1}{T} \int_0^T E^2 e^{-4t} dt = \frac{E^2}{T} \cdot \left. -\frac{1}{4} e^{-4t} \right|_0^T = \frac{E^2}{4T} \cdot e^{-4t} \Big|_0^T = \frac{E^2}{4T} (1 - e^{-4T}) = \frac{E^2}{8} (1 - e^{-2}) = \boxed{\frac{E^2}{8}} \\
 &= 0,125 E^2
 \end{aligned}$$

$$P_{out} = |X_0|^2 + 2|X_1|^2 = \frac{E^2}{16} + 2 \cdot 0,017956 E^2 = \boxed{0,098 E^2}$$

$$\eta = \frac{P_{out}}{P} = \frac{0,098 E^2}{0,125 E^2} = 0,784 = \boxed{78,4\%}$$

2.

$$A_{\min} = -3 + 2 = -1$$

$$A_{\max} = 3 + 2 = 5$$

$$\Delta = \frac{5 - (-1)}{5} = \frac{6}{5} = 1,2V$$

$$q=5 \Rightarrow u=3$$

$$1^{\circ} \quad \begin{matrix} (0,0) \\ (\frac{T}{2}, -A) \end{matrix} \quad x(t) = \frac{-A \cdot 2}{T} \cdot t$$

$$2^{\circ} \quad \begin{matrix} (\frac{T}{2}, A) \\ (T, 0) \end{matrix} \quad x(t) = \frac{-A \cdot 2}{T} (t - T) = \frac{-2A}{T} t + 2A$$

$$y(t) = x(t) + 2$$

$$y(0) = 2V$$

$$y(1) = -\frac{2A}{T} + 2 = -\frac{6}{7} + 2 = \frac{8}{7} \approx 1,14V$$

$$y(2) = -\frac{4 \cdot 3}{7} + 2 = -\frac{12}{7} + 2 = \frac{2}{7} \approx 0,29V$$

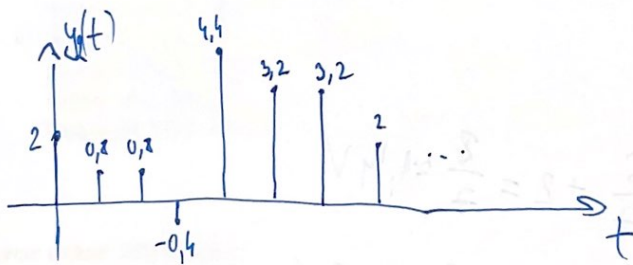
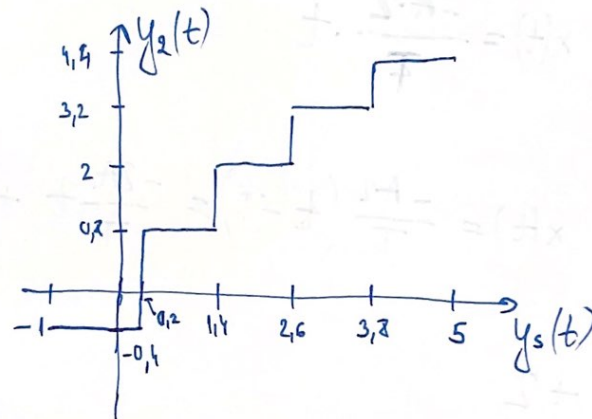
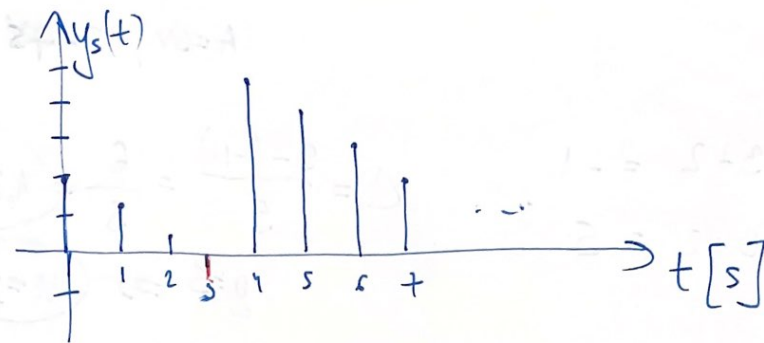
$$y(3) = -\frac{6 \cdot 3}{7} + 2 = -\frac{18}{7} + 2 = -\frac{4}{7} \approx -0,57V$$

$$y(4) = -\frac{8 \cdot 3}{7} + 6 + 2 = -\frac{24}{7} + 8 = \frac{32}{7} \approx 4,57V$$

$$y(5) = -\frac{10 \cdot 3}{7} + 6 + 2 = -\frac{30}{7} + 8 = \frac{26}{7} \approx 3,71V$$

$$y(6) = -\frac{12 \cdot 3}{7} + 6 + 2 = -\frac{36}{7} + 8 = \frac{20}{7} \approx 2,86V$$

$$y(7) = -\frac{14 \cdot 3}{7} + 6 + 2 = -\frac{42}{7} + 8 = \frac{14}{7} = 2V = y(0)$$



0	1	2	3	4
-0.4	0.2	2	3.2	4.4
000	001	010	011	100

