if you had any question, please feel free to contact me by email dr.manzuri.signal@gmail.com

1. Discuss the properties ‘causality’, ‘linearity’, and ‘time invariance’ of systems below:

i. \[ y(t) = \int_{-\infty}^{t} x(\alpha) e^{\alpha} d\alpha \]
ii. \[ y(t) = x\left(-\sqrt{|t|}\right) \]
iii. \[ y(t) = \int_{-2t}^{2t} x(\alpha) u(t - \alpha) d\alpha \]
iv. \[ y[n] = x[-|n|] \]
v. \[ y(t) = \begin{cases} x(t - 1) & x(t - 1) \leq 1 \\ x(t + 1) & x(t - 1) > 1 \end{cases} \]
vi. \[ y[n] = a^x[n] \]
vii. \[ y[n] = \sum_{N=2}^{+\infty} x[kN] \delta[n - kN] \]

2. Discuss the properties ‘stability’ and ‘invertibility’ of systems below:

i. \[ y[n] = x[n \text{ mod } 27] \]
ii. \[ y[n] = \sum_{k=-\infty}^{\infty} x[k] \delta[n - 2k] \]
iii. \[ y(t) = \begin{cases} x(t) + x(-t) & x(t - 1) \leq 1 \\ x(t) - x(-t) & x(t - 1) > 1 \end{cases} \]
iv. \[ y[n] = x[n^2] \]
v. \[ y(t) = \begin{cases} tx(t) & 0 \leq t < 1 \\ x(t + 1) & t < 0 \end{cases} \]

3. Discuss the memory property of a system whose responses to \( x_i(t) \) are \( y_i(t) \).

\[
\begin{align*}
x_1(t) &= t + 4 ; & y_1(t) &= t^3 \\
x_2(t) &= 5u(t) ; & y_2(t) &= 6 - 5t
\end{align*}
\]
4. The response of LTI, not memory system to \( x_1(t) \) is \( y_1(t) \). What is its answer to \( x_2(t) \)?

5. The response of non-linear, time-variance, not memory system to \( x_1(t) \) is \( y_1(t) \). What is its answer to \( x_2(t) \)?

6. Investigate the properties (linearity, time invariance, memory, causality, stability) of system below: