Classification, linearity, time-invariance and causality, impulse response

What is System?

- Systems process input signals to produce output signals

- A system is combination of elements that manipulates one or more signals to accomplish a function and produces some output.

input signal → **system** → **output signal**

Examples of Systems

- A circuit involving a capacitor can be viewed as a system that transforms the source voltage (signal) to the voltage (signal) across the capacitor

- A communication system is generally composed of three sub-systems, the transmitter, the channel and the receiver. The channel typically attenuates and adds noise to the transmitted signal which must be processed by the receiver

- Biomedical system resulting in biomedical signal processing

- Control systems

Causal & Anticausal Systems

- Causal system : A system is said to be *causal* if the present value of the output signal depends only on the present and/or past values of the input signal.

- Example: $y[n]=x[n]+1/2x[n-1]$

Causal & Anticausal Systems Contd.

- Anticausal system : A system is said to be *anticausal* if the present value of the output signal depends only on the future values of the input signal.

- Example: $y[n]=x[n+1]+1/2x[n-1]$

Linear & Non Linear Systems

- A system is said to be linear if it satisfies the principle of superposition

- For checking the linearity of the given system, firstly we check the response due to linear combination of inputs

- Then we combine the two outputs linearly in the same manner as the inputs are combined and again total response is checked

- If response in step 2 and 3 are the same,the system is linear othewise it is non linear.