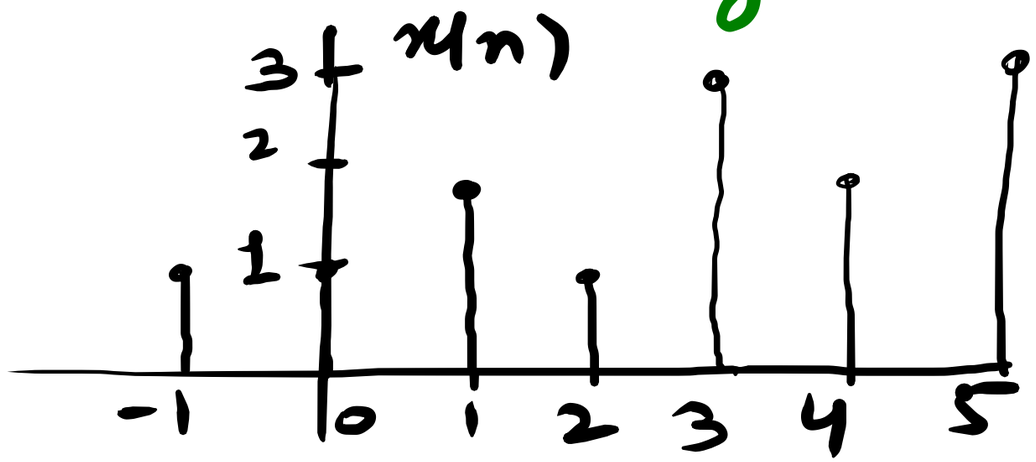
3. Continuous valued - If a signal takes all possible values on a finite or infinite range.

4. Discrete valued:- values from a finite set of possible values.

A discrete time signal having a set of discrete values is called a digital signal.

ex-



{1, 2, 3, 4}
set of values

digital signal takes on one of four possible values

Analog vs Digital

A. Speech, audio & video, popularly the 'message' signals — generation & consumption — are analog 'message' — implies it contains information

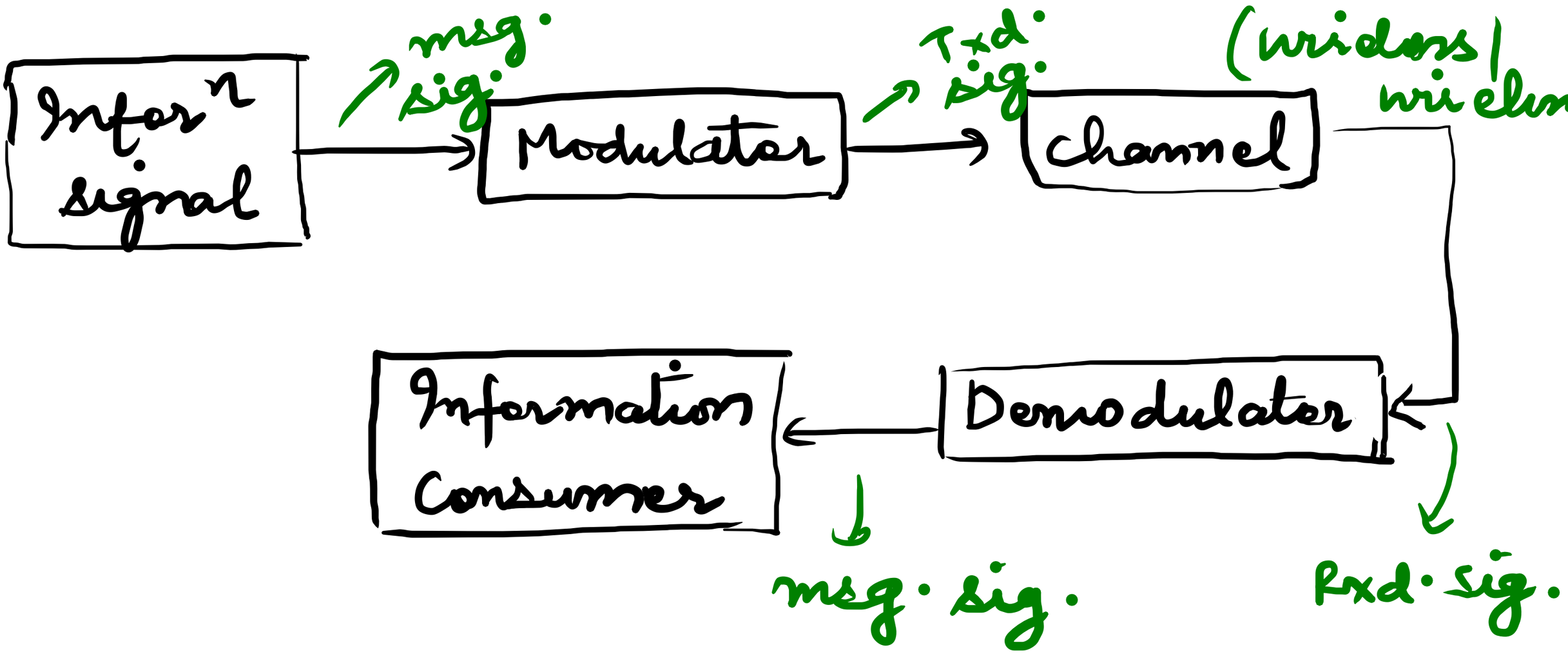
B. Txd. signal corresponding to physical comm. media are also analog. ex- wirelers & optical comm. employ EM waves.

Analog communication:- (Ac)

Given analog nature of both the message & the comm. medium, natural choice is to map

analog msg. signal to an analog Txd. signal that is compatable with the physical medium over which we wish to communicate. This is AC

ex- AM, FM, 1G cellular phone technology



ex- an audio signal, translated from the acoustic to the electrical domain using a microphone →

radiowave carrying the audio signal →

Broadcast audio over the air from an FM radio station.

What we see around is Digital Comm. mostly.

→ Digital comm. (DC) :- "Comm. in terms of bits"

foundation was laid by Claude Shannon in 1948.

Two main threads:- 1) Source coding & Compression

2) Digital information transmission.

') involves compression or removal of redundancy in a manner that exploits the properties of the source signal. (ex- heavy correlation (spatial) among adjacent pixels in an image can be exploi-ted to represent it more efficiently than a pixel by pixel repres.

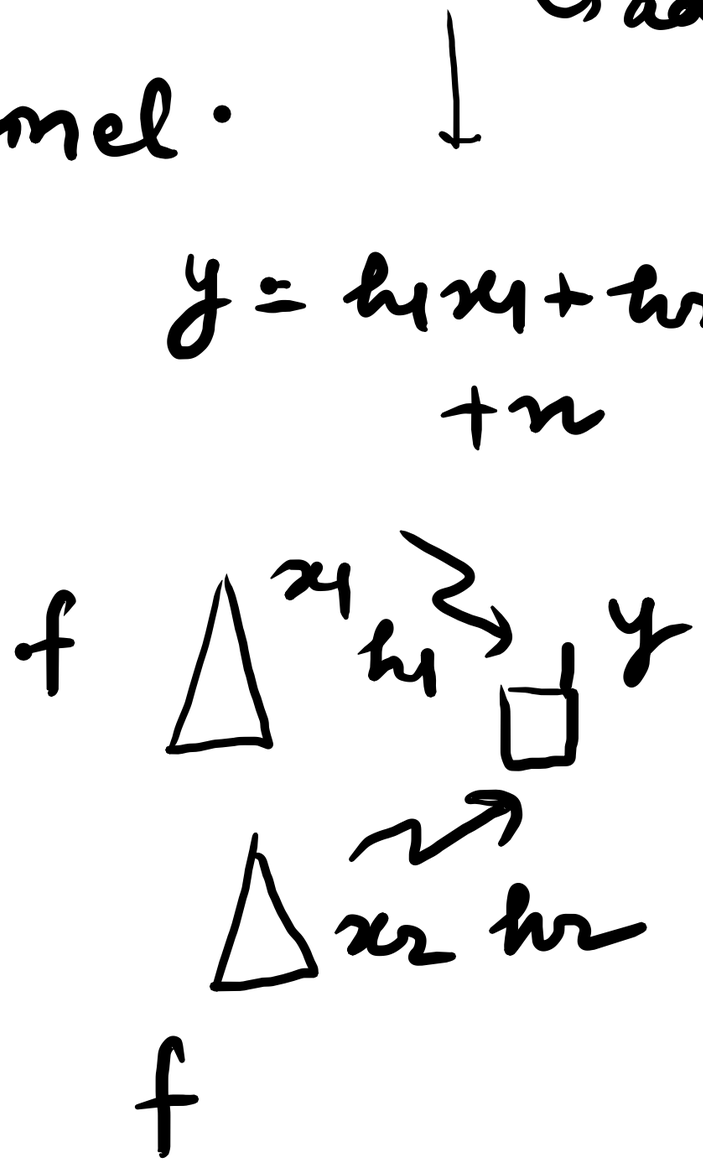
2) Once source coding is done, task is to 'reliably' transfer bit seq. across space or time. Notion of Channel capacity (CC)
(see the definition of CC from any standard text in Comm. theory)

Three factors affecting Tx:- (DC system)

1. Signal strength
2. noise or interference
3. distortions imposed by channel.

$(y = hx + n)$ — h: multiplicative; n: additive

$y = h_1 x_1 + h_2 x_2 + n$



Once these are fixed for a Comm^n. channel, CC gives the maximum possible rate of reliable Comm^n

$y = x + n$, $\frac{1}{2}\log_2\left(1 + \frac{P}{\sigma^2}\right)$

$y = hx + n$, $\frac{1}{2}\log_2\left(1 + \frac{P|h|^2}{\sigma^2}\right)$