Analog and Digital Data Transm[illegible]

* The term analog and digital refers to continuous and discrete respectively.
* Data, signals, Information Transmission

Data	Signals	Transmission
Information	Electromagnetic representation of data	Communication of data by propagation

Analog and Digital Signalling:-

Analog signalling:- It is continuously varying EM wave

Channel Capacity:-

* A variety of impairment can distort or corrupt a signal
* The maximum rate at which data can be transmitted over given communication path or channel under given conditions refer to as channel capacity.

* Data rate:- This is data rate bits per second at which data can be communicated.
* Bandwidth:- It is the volume of data that can be transmitted over given comm^n medium.

Cycles per second (bps)

Error Rate:- The rate at which error occur is called error rate.

Shannon Capacity Theorem:-

$$C = B \log_2 [1 + S/N]$$

C = channel capacity B = Bandwidth

S = Signal N = Noise power

Signal + Noise = Received. (At the receiver side)

It's mean square $= \sqrt{S+N}$

Noise power N then $\underbrace{MSV}_{\text{mean square value}} = \sqrt{N}$

No of Levels separated without error

$$m = \frac{\sqrt{N+S}}{\sqrt{N}} = \sqrt{1 + \frac{S}{N}}$$

So Information

$$I = \log_2 m$$

$$= \log_2 \sqrt{1 + S/N}$$

$$= 1/2 \log_2 (1 + S/N)$$

If channel transmit K pulses per second then channel capacity $C = IK = \frac{K}{2}\log_2(1+S/N)$

Nyquist bandwidth $K = 2B$

$$\boxed{C = \frac{\cancel{2}B}{\cancel{2}}\log_2(1+S/N) = B\log_2(1+S/N)}$$

If bandwidth increases the capacity C will also increase so we cannot have infinite channel capacity.

For a typical telephone line with a signal to noise 30dB & audio bandwidth is 3KHZ what is max. data rate

$SNR = 3dB$

$B = 3KHZ$

$$\begin{array}{l} dB \\ 10 - 10 \\ 20 - 10^2 \\ 30dB = 10^3 \end{array}$$

$SNR = 10^3$

$$C = B\log_2(1+S/N)$$
$$= 3KHZ\log_2(1+1000)$$
$$= 3\times10^3\log_2(1001)$$
$$\boxed{C = 3\times10^3\frac{\log(1001)}{\log 2} \quad 3\times10^6}$$

$C = 3\times10^6$ bps $= 3$ mbps

$SNR = 20dB$ and video b/w = 10MHZ

$C = 10\times10^6\log_2(1+10^2) = 10\times10^6\log_2(101)$

$= 10^7\frac{\log(101)}{\log 2}$