

## Science and Technology Class 09

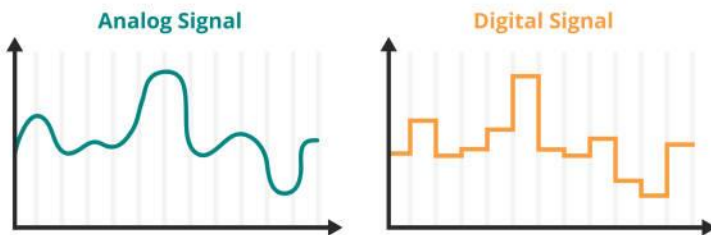
6th August, 2023 at 9:00 AM

### A BRIEF REVIEW OF THE PREVIOUS CLASS (09:10 AM)

- Coding of messages- EM Radiation

### IMPORTANT TERMINOLOGIES (09:11 AM)

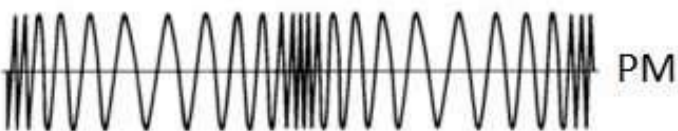
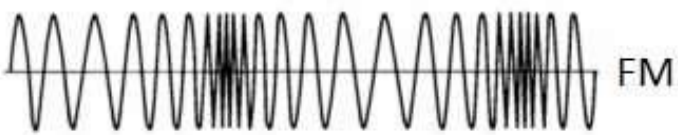
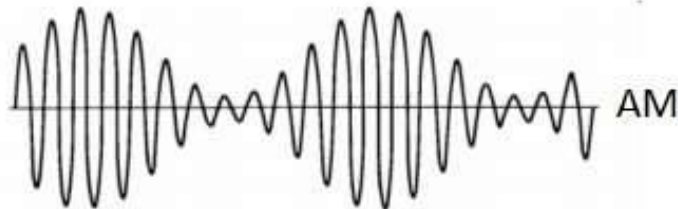
- **Signal-**
- Information converted in electrical form and suitable for transmission is called Signal.
- It can be of two types-
- Analog || Digital



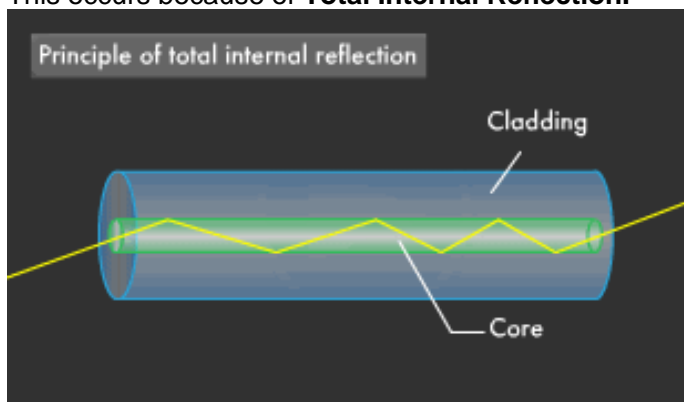
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- The term 'Noise' refers to an unwanted signal that tends to disturb the transmission and processing of a message signal.
- Analog Signals are continuous variations of voltage or current.
- For Eg: Sound and picture signals in satellite television, Radio, etc
- Digital Signals can take discrete stepwise values.
- Thus 0 corresponds to a low-level voltage and 1 corresponds to a high-level voltage.
- Using ASCII (American Standard Code for Information Interchange) system various types of data like texts, images, etc can be used as Binary signals.
- Digital Signals allow for greater precision in transmission, can be easily coded and decoded, and is less prone to noise.
- **Attenuation and Amplification- (09:38 AM)**
- The loss of strength of a signal while propagating through a medium is known as **Attenuation**.
- **Amplification** is the process of increasing the strength of the signal to compensate for Attenuation.
- For Amplification, we need a power source.
- **Range-**
- It is the largest distance between a source and a destination up to which a Signal is received with sufficient strength.
- **Bandwidth- (09:46 AM)**
- It refers to the frequency range over which equipment operates or the portion of the Spectrum occupied by the signal.
- It depends upon the type of signal.
- Different types of transmission mediums offer different bandwidths.
- For eg: Coaxial cables made up of copper provide less bandwidth, and free space (wireless communication) provides more bandwidth.
- Optical fibre cables provide the highest bandwidth.

- **Modulation- (09:57 AM)**

- The original low-frequency information signal cannot be transmitted over long distances.
- Therefore, at the transmitter information is superimposed on a high-frequency wave that acts as a carrier of the information.
- This process is known as Modulation.
- There are several types of Modulation-
- Amplitude (AM) || Frequency (FM) || Phase (PM)



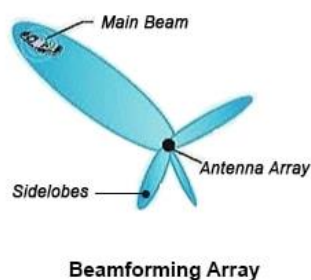
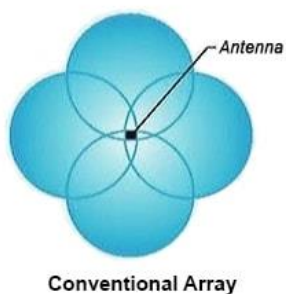
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- The process of retrieval of information from the carrier wave at the receiver is called **Demodulation**.
- **Repeater-**
- It is a combination of receiver and transmitter.
- It picks up the signal from the transmitter, amplifies it, and re-transmits it to the receiver.
- **Optical Fiber Cables- (10:35 AM)**
- Optical Fiber Cables are the most important tools for modern communication systems because signals can travel for 100s of kilometres without degradation.
- This occurs because of **Total Internal Reflection**.



## • 5G TECHNOLOGY (11:07 AM)

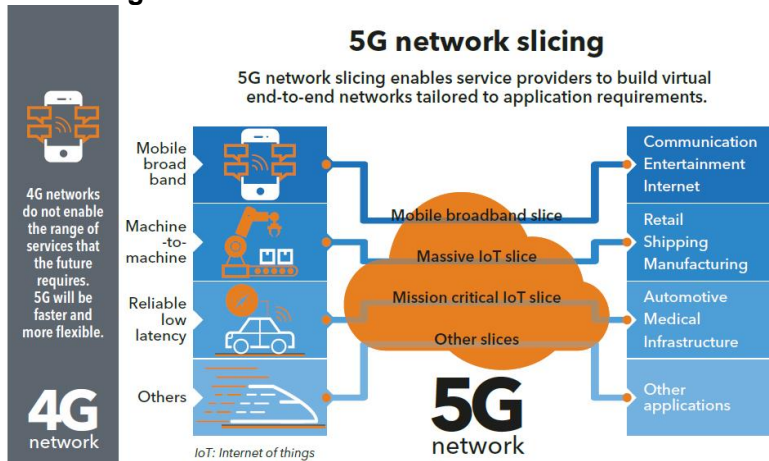
Feature	4 G	5 G
Average Speed	100 Mbps	600-800 Mbps
Peak Data rate	1 Gbps	20 Gbps
Latency	20-30 ms	1ms approx
Connection density	100,000 per sq km	1, 000,000 per sq km
Available Spectrum	3GHz	30 GHz

- The standards are decided by
- International Telecommunication Union
- 3GPP- 3rd Generation Partnership Project
- 3GPP is a collaboration of several telecommunication standardization organizations.
- For Eg: TSDSI- Telecommunication Standard Development Society of India
- 5G is not one technology but an amalgamation of many such as -
- **High-Frequency Waves (mm waves)-**
- 5G utilizes higher frequency bands including mm waves which allows for increased data capacity.
- **Small Cell Stations-**
- Because of the use of high frequency 5G signal has less range.
- This is because of scattering, absorption, due to the atmosphere, the presence of solid objects, etc.
- This leads to signal degradation.
- Small cells can receive and transmit thousands of signals in a small geographical range.
- They consume less power, however, their density is more than previous-generation mobile networks.
- **Massive MIMO-**
- Use of a large number of antennas which enables multiple data streams to be transmitted and received simultaneously.
- **Beam Forming-**



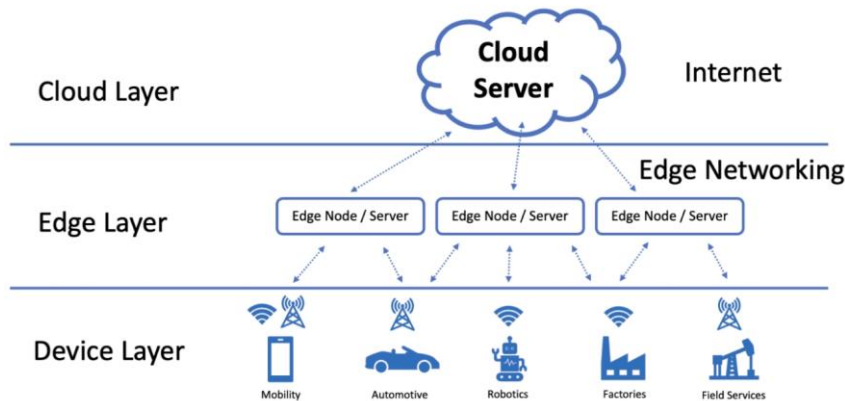
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- It is a technique to focus the transmission and reception of signals in specific directions.
- This leads to enhanced signal quality, coverage, and capacity.

- **Network Slicing-**



- It enables the creation of multiple virtual networks within a single physical infrastructure.
- Each network slice can be customized to meet specific requirements.
- **Edge Computing-**

**Simple Edge Computing Architecture**



- In Edge Computing the data storage and processing occur at the edge of the network rather than use of Cloud infrastructure.
- It reduces latency and enables faster processing of data.

**TOPICS TO BE DISCUSSED IN THE NEXT CLASS- BENEFITS OF 5G, CHALLENGES ASSOCIATED WITH 5G**