

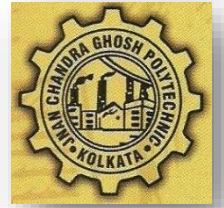
**Elementary Communication Engg,  
Department of Electronics & Telecommunication  
Engineering**

**Jnan Chandra Ghosh Polytechnic**

**Semester- 4**

**Simple Diode detectors/AGC/FM Transmitters-  
Receivers**

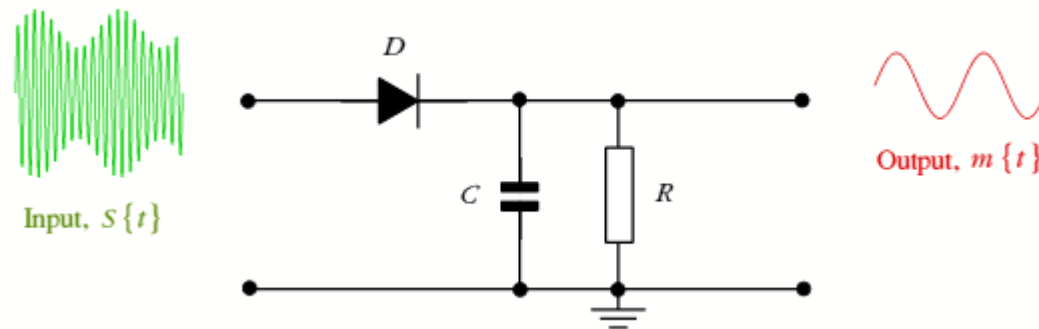
**Smt. Kaberi Chatterjee Polley, Lecturer**



# SIMPLE DIODE DETECTOR-1

## Also known as Envelope detector

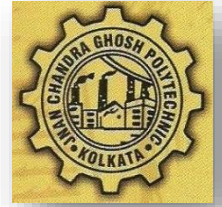
- By far the most common device used for AM demodulation
- The process of extracting the modulating signal from modulated signal is called demodulation



Envelope Detector (AM Demodulator/Detector).

- In the circuit  $C$  is small capacitance and  $R$  is a large resistance. The parallel combination of  $R$  and  $C$  is load resistance across which the rectified output voltage is developed.
- AT each positive peak of the RF cycle  $C$  charges up to the peak signal voltage and so that diode is forward biased.
- During the negative peak the diode is reverse biased and the charged capacitor discharges through the resistance.
- The result is the voltage ( $V_o$ ) which reproduces the modulating voltage accurately.

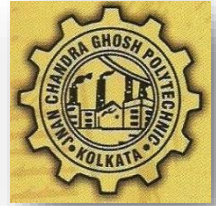
# SIMPLE DIODE DETECTOR-2



## Points to be noted --

- The time constant of RC combination must be slow enough to keep the RF ripple as small as possible
- The simple detector has the disadvantage that  $V_o$  in addition to being proportional to the modulating voltage also has a DC component.
- The DC component represents average envelope amplitude that is carrier strength and the small RF ripple

# AUTOMATIC GAIN CONTROL (AGC)

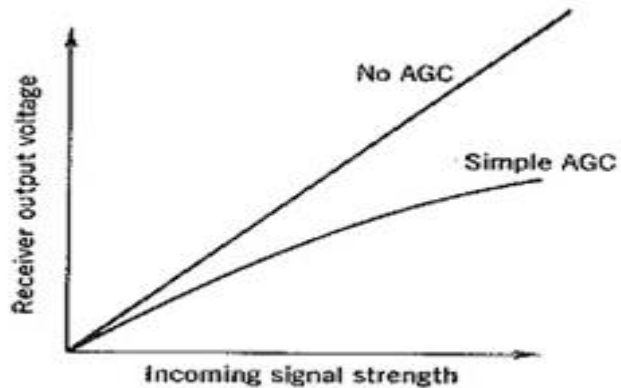


## PRINCIPLE OF AGC –

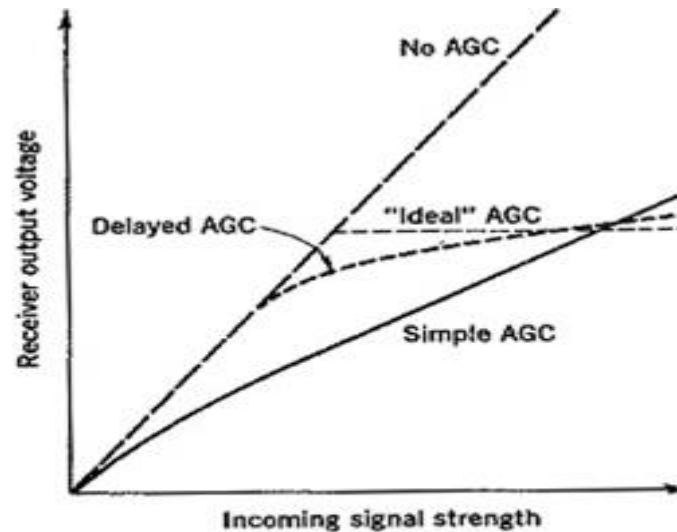
Simple AGC is a system by means of which the overall gain of a radio receiver is automatically varied with the changing strength of the received signal to keep the output substantially constant.

All modern receivers are furnished with AGC, which enables tuning to station of varying signal strengths without any appreciable change with the size of the output signal.

Thus AGC irones out input signal amplitude variations



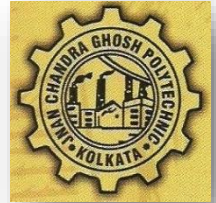
**SIMPLE AGC CHARACTERISTICS**



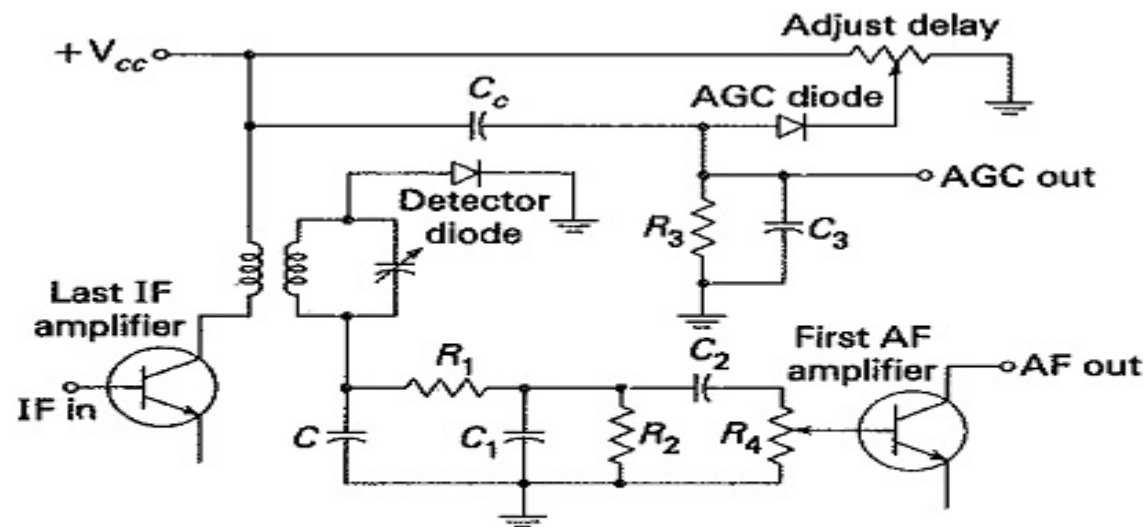
**VARIOUS AGC CHARACTERISTICS**

# AUTOMATIC GAIN CONTROL (AGC)

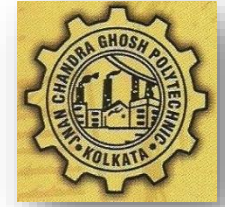
## (Various AGC Characteristics)



- If we study the AGC characteristics graph we shall see that simple AGC is clearly an improvement on no AGC at all i.e. the gain of the receiver is reduced for strong signals
- But unfortunately weak signals also get reduced
- Here comes the concept of delayed AGC. i.e. the AGC bias is not applied until the signal strength has reached pre determined level, after which bias is applied as with normal AGC but more strongly.



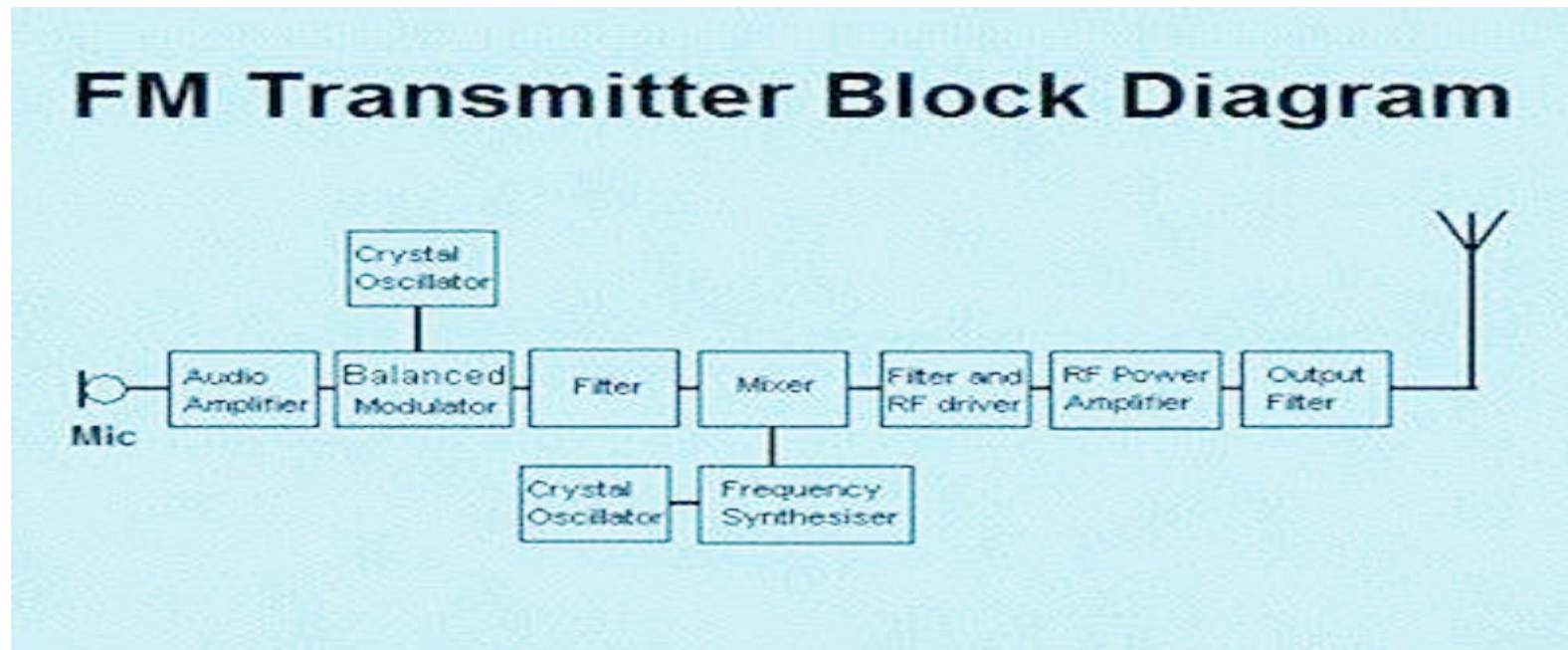
**Delayed AGC circuit.**



# FM TRANSMITTER

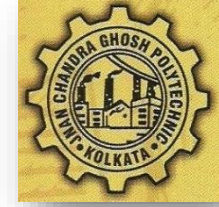
**FM Transmitter:** FM Transmitter is the system, which takes the audio signal as an input and delivers FM wave to the antenna as an output to be transmitted.

Below is the block diagram of FM Transmitter:



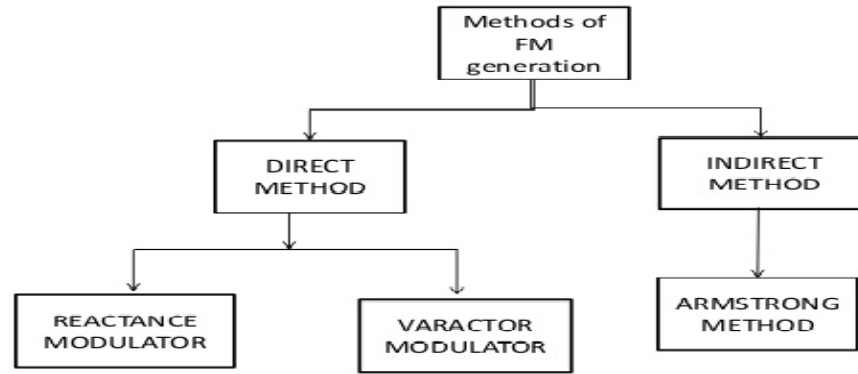
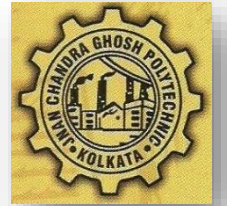
# FM TRANSMITTER

(Explanation of Block Diagram)



- The audio signal from the output of the microphone is sent to the pre-amplifier which boosts the level of the modulating signal.
- The signal is then passed to high pass filter which acts as a pre-emphasis network to filter out the noise and improve the signal to noise ratio.
- The signal is further passed to the FM modulator circuit
- Several stages of frequency multiplier are used to increase the operating frequency.
- Lastly a RF power amplifier is used at the end to increase the power of the modulated signal. This FM modulated output is finally passed to the antenna to be transmitted.

# DIRECT FM MODULATION



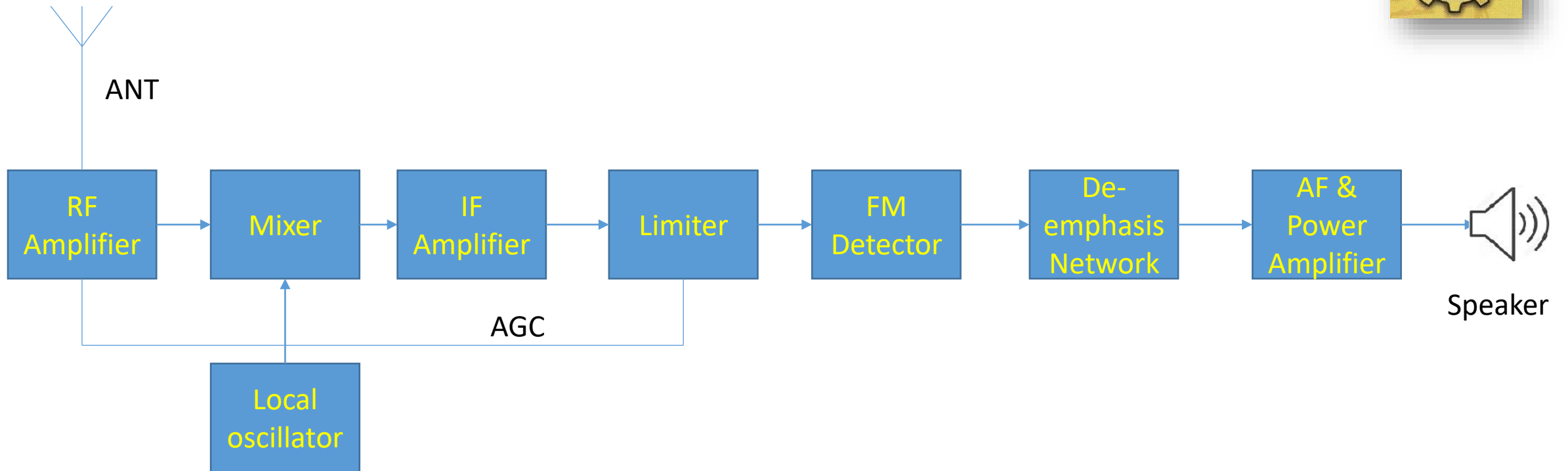
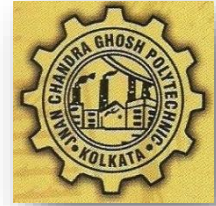
CLASSIFICATION OF FM GENERATION METHODS

## Points to be noted:

- **Direct FM Modulation-** Frequency of the carrier changes according to modulating signal.
- **Advantages of Direct FM :** Easy to obtain high frequency deviation
- **Approaches to create direct FM:**
  - Varactor diode modulators.
  - FM reactance modulators.
  - IC based modulators.

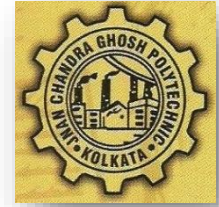


# SUPERHETERODYNE FM RECEIVER



# SUPERHETERODYNE FM RECEIVER

## (Different Stages)



**RF Amplifier** : RF Amplifier is used in FM to improve S/N ratio. Matches receiver input impedance to receiver antenna impedance.

**Local Oscillator**: Variable frequency oscillator which is fed into the mixer.

**Mixer** : Down converts the received signal to IF (Intermediate Frequency)

**IF Amplifier** : Amplifies IF Frequency to the desired level

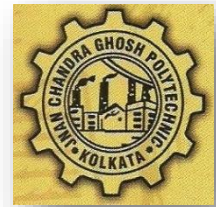
- FM requires high bandwidth
- IF =10.7 Mhz & BW = 200khz

**Amplitude Limiter** : Ideally amplitude remains constant.

- Practically Random noise & other signals get added to modulated signal, therefore amplitude changes . These changes must be eliminated before demodulation.
- Limiter removes all these unwanted signals

**FM Demodulator** : Demodulates the FM wave and extracts the information signal .

**De-Emphasis** : De-emphasis means attenuating those frequencies by the amount by which they are boosted. However pre-emphasis is done at the transmitter and the de-emphasis is done in the receiver.



# RECEIVER CHARACTERISTICS

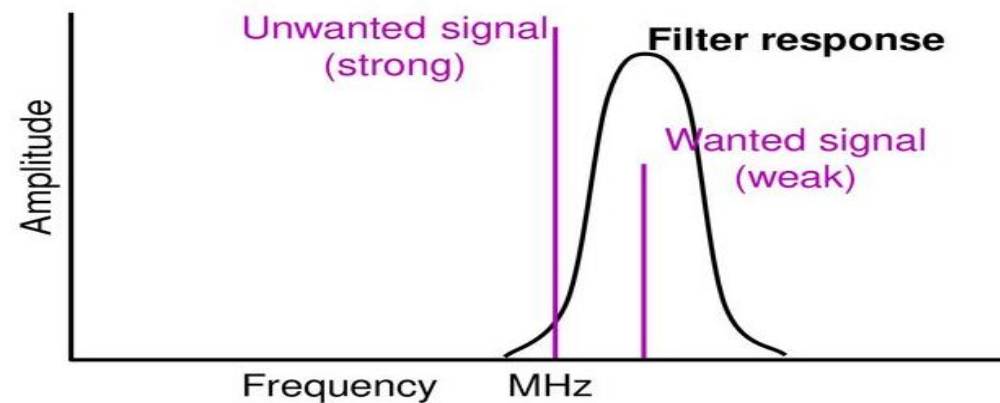
**Sensitivity** : Sensitivity of receiver explains how much weak signal is detected by a receiver. Sensitivity of radio receiver is its ability to amplify weak signals. It is often expressed in microvolts or in decibels below one volt. RF and IF amplifier gain decides the sensitivity of receiver

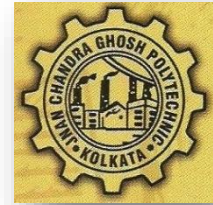
Issues: If the gain is increased it will give rise to unstable system so moderate gain is used at stable frequency.

**Selectivity** : Selectivity of a receiver is its ability to reject adjacent unwanted signals. It depends on quality factor of receiver.

$$Q = f_c / BW$$

- **Selectivity** is the ability to separate the wanted signal from nearby unwanted signals (other stations)





# RECEIVER CHARACTERISTICS

- **Fidelity:** The ability of a receiver to reproduce faithfully all the frequency components in the baseband signal is called Fidelity. Fidelity is difficult to obtain in Am receiver because good fidelity requires more bandwidth.
- Radio Receiver should have high Fidelity or Accuracy
- Any variation in demodulated signal which is not present in original signal should be treated as distortion
- Example- In an AM Broadcast maximum audio frequency is 5KHz , hence receiver with good fidelity must reproduce entire frequency up to 5KHz.

