

### EXPERIMENT NO. 3

#### FREQUENCY MODULATION AND DEMODULATION

**AIM:** To study of frequency modulation and demodulation.

#### **APPARATUS :**

1. FM modulation and demodulation kit
2. Dual trace CRO.
3. CRO probes
4. Patch cards.

#### **THEORY:**

The modulation system in which the modulator output is of constant amplitude, in which the signal information is super imposed on the carrier through variations of the carrier frequency.

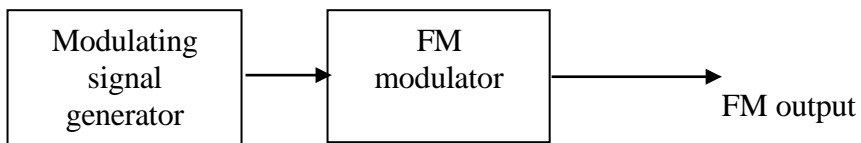
The frequency modulation is a non-linear modulation process. Each spectral component of the base band signal gives rise to one or two spectral components in the modulated signal. These components are separated from the carrier by a frequency difference equal to the frequency of base band component. Most importantly the nature of the modulators is such that the spectral components which produce decently on the carrier frequency and the base band frequencies. The spectral components in the modulated wave form depend on the amplitude.

The modulation index for FM is defined as

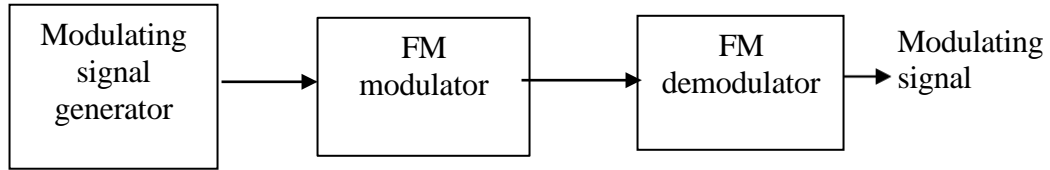
$$M_f = \frac{\text{max frequency deviation}}{\text{modulating frequency}}$$

#### **BLOCK DIAGRAM:**

##### **Modulation**



**Demodulation**



**PROCEDURE:**

1. Switch on the experimental board.
2. Observe the FM modulator output without any modulator input which is the carrier signal and note down its frequency and amplitude.
3. Connect modulating signal to FM modulator input and observe modulating signal and FM output on two channels of the CRO simultaneously.
4. Adjust the amplitude of the modulating signal until we get less distorted FM output.
5. Apply the FM output to FM demodulator and adjust the potentiometer in demodulation until we get demodulated output.

OBSERVATIONS:

**Modulation**

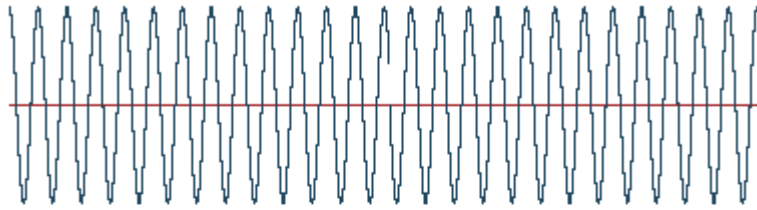
<b>V<sub>m</sub></b>	<b>F1</b>	<b>F2</b>	<b>Frequency deviation F<sub>d</sub> (f1-f2)</b>	<b>Modulating index (f1-f2)/F<sub>m</sub></b>	<b>Band width= 2(F<sub>d</sub>+F<sub>m</sub>)</b>

**Demodulation**

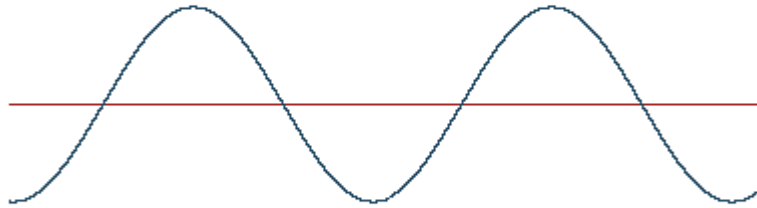
<b>Modulating signal frequency</b>	<b>Demodulating signal frequency</b>

## **EXPECTED WAVEFORMS:-**

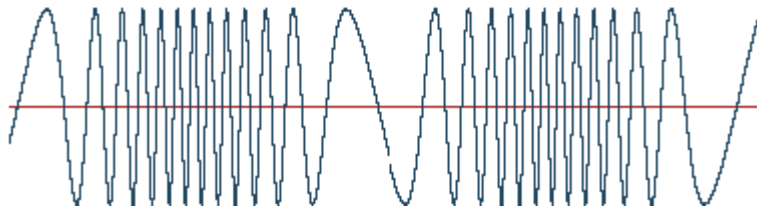
Carrier



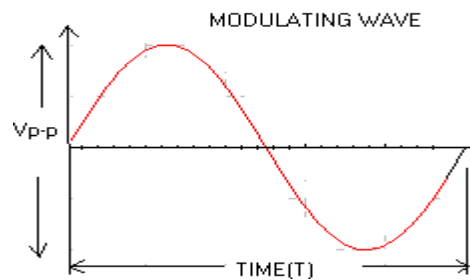
Modulating Wave



Modulated Wave



**Demodulated signal**



## **RESULT:**

### **QUESTIONS**

1. Define FM & PM.
2. What are the advantages of Angle modulation over amplitude modulation?
3. What is the relationship between PM and FM?
4. With a neat block diagram explain how PM is generated using FM.