EXPERIMENT#5

TO ANALYZE FREQUENCY MODULATION

OBJECTIVE:

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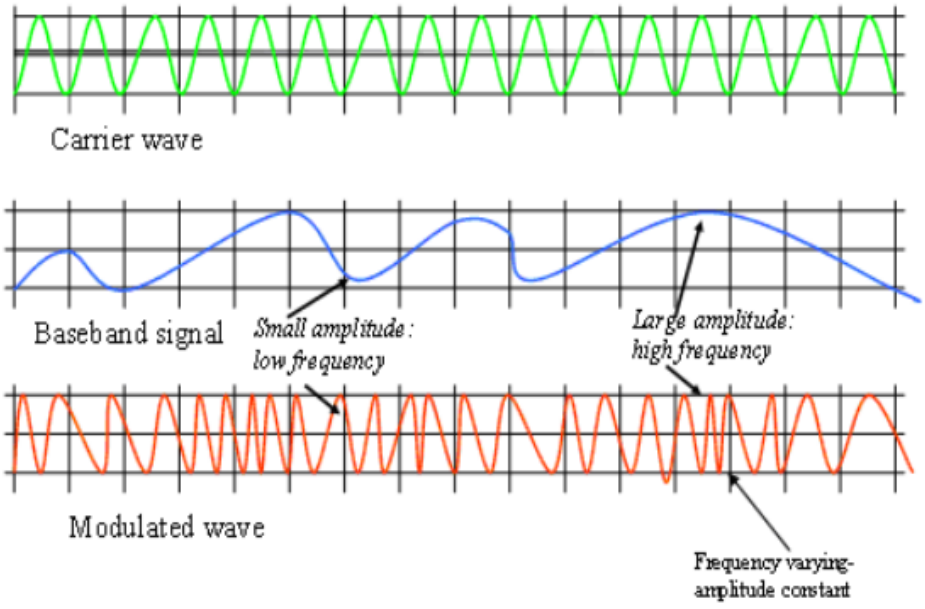
FREQUENCY MODULATION:

In telecommunications and signal processing, frequency modulation (FM) is the encoding of information in a carrier wave by varying the instantaneous frequency of the wave. This contrasts with amplitude modulation, in which the amplitude of the carrier wave varies, while the frequency remains constant.

To generate the frequency modulated signal, the frequency of the carrier wave is changed in line with the amplitude of incoming signal. High amplitude will generate high frequency signal whereas, low amplitude will generate the low frequency signal.



FREQUENCY DEVIATION:

When the signal is frequency modulated it moves up and down in frequency. The amount by which the signal is moved up and down is called the frequency deviation.

The equation representing FM wave form is;

$$s_{FM} = A_c \sin\left(\omega_c t + m_f \sin \omega_m t\right)$$

s_{FM} = instantaneous voltage of the FM wave

A_c = peak amplitude of the carrier

ω_c = angular velocity of the carrier

ω_m = angular velocity of modulating signal

$\omega_c t$ = carrier phase

$\omega_m t$ = modulation phase

m_f = FM modulation index

MODULATION INDEX:

The ratio of maximum frequency deviation to the modulating signal frequency is called the modulation index.

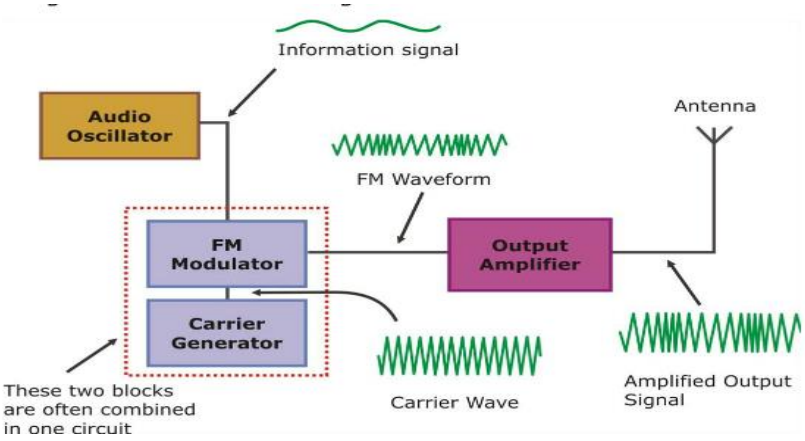
$$m_f = \frac{\delta}{f_m}$$

where m_f = modulation index of FM

δ = maximum frequency deviation of the carrier caused by the amplitude of the modulating signal

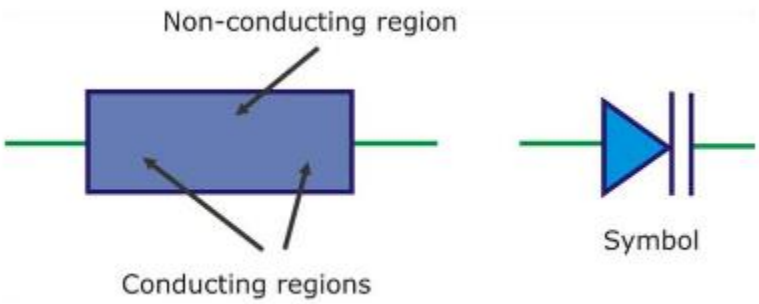
f_m = frequency of the modulating signal

BLOCK DIAGRAM:

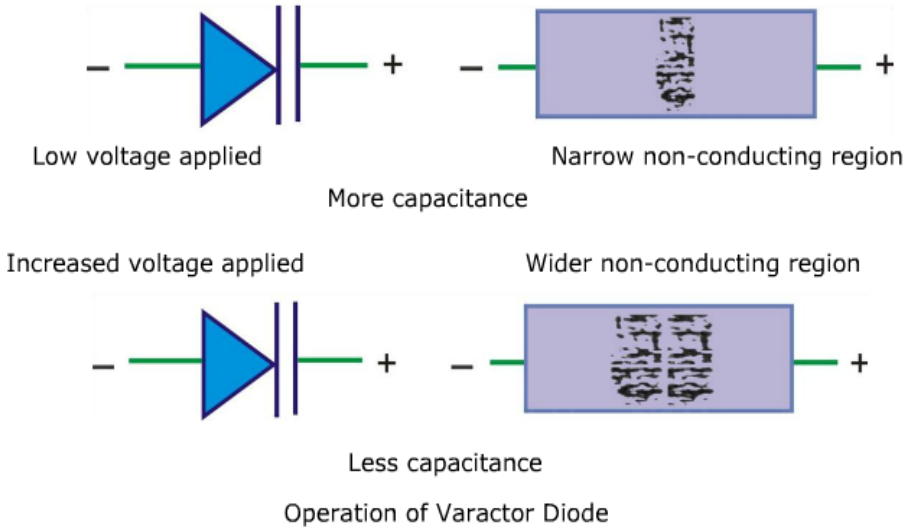


VARACTOR MODULATOR:

Varactor modulator uses the varactor diode, which is the semi conductor diodedesigned to behave as a voltage control capacitor. The construction is similar to the capacitor. It consists of two conducting regions separated by the non conducting region.



By applying low voltage, the width of non-conducting region will be decreased and will have more capacitance whereas, less capacitance for the increasing voltage.



Operation of Varactor Diode

EQUIPMENT USED:

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MAIN COMPONENTS:

AUDIO OSCILLATOR: With adjustable amplitude and frequency (300Hz-3.4 KHz)

FM MODULATOR: Varactor Modulator

MIXER/AMPLIFIER: FM input signal amplitude modulated by the noise. Also provide the input signal to demodulator

PROCEDURE:

Lab Task :

Observe the output of FM Modulation ST2203and attach the output.

CONCLUSION:

Post Lab Questions

a) **What are the methods used for FM Modulation?**

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b) **Which method of modulation is most preferable (AM or FM) ?**

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c) **What is the function of Varactor?**

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